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ABSTRACT

The goal of this project was to develop, validate, and utilize a process for vertically articulating curriculum between secondary and post secondary levels of vocational technical education throughout the state of Minnesota. Procedures involved the identification of two areas of staff responsibility: research and development, and service to local vocational-technical institutions in Minnesota. Within these areas, functions and objectives were identified and delimited so that the project could be managed by objectives. The results of the project include the following: a developed, validated, and utilized procedure for developing articulation products (task lists and competency records) on a statewide basis in the occupational areas of auto mechanics, secretarial/clerical, food service, construction and accounting; and a process for teachers and administrators to follow as they articulate secondary and postsecondary curriculum. Publications were also developed, printed, and field tested for the purpose of guiding teachers in making decisions during articulation sessions. It was concluded that this system can be used on a continuing basis to update, revise, and impact upon the quality of vocational technical curriculum throughout the state. Five recommendations were made, one being that an active advisory board would be necessary to give a broad decision-making base for the administration of public funds. The appendixes (a major portion of this document) include a vocational instructor's guide on developing performance tests and written tests, an articulation process manual for administrators and consultants on site, and a complete listing of products developed by the project. (JH)

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STATEWIDE CURRICULUM ARTICULATION
PROJECT FOR VOCATIONAL - TECHNICAL
EDUCATION IN MINNESOTA

A FINAL REPORT

PROJECT NUMBER: 17 - B - 77

CONDUCTED USING GRANT AWARDED BY
DIVISION OF VOCATIONAL - TECHNICAL EDUCATION
MINNESOTA DEPARTMENT OF EDUCATION
UNDER PART C/D OF PUBLIC LAW 90-576

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U.S. DEPARTMENT OF HEALTH,
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FINAL REPORT

Project Number: 17-B-77

STATEWIDE CURRICULUM ARTICULATION PROJECT
for VOCATIONAL - TECHNICAL EDUCATION
in MINNESOTA

Research and Development Project
in Career Education

Conducted Using Grant Awarded by
Division of Vocational-Technical Education
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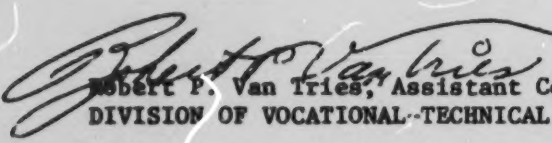
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Laura J. Burger, PH. D.
Director, 1976-77

Preface

Over the past years, the state of Minnesota has demonstrated a strong commitment to vocational education. There are now 33 post secondary vocational education institutions. Approximately 10 years ago, provisions were made to support the growth and development of vocational programs at the secondary level. A priority was placed on assisting groups of districts that wish to share dollars and students to offer a greater variety of vocational programs to secondary students. Fifty-seven cooperative centers offer vocational training to secondary school students at the present time. It is anticipated that others will be developed until 75 centers serve all districts in Minnesota. Secondary vocational programs are also offered at 400 high schools in Minnesota.

Forseeing the problems that could result from the lack of vertical curriculum articulation between secondary and post secondary educational offerings, there emerged a need for this research project. Vertically articulated programs, when achieved, allow students to progress from secondary to post secondary programs, from secondary programs to the world of work, and from the world of work to post secondary institutions without gap or overlap in vocational instruction. It is anticipated that the findings from this study will be useful for adult vocational programs as well. The problem of "how do we, in Minnesota, achieve vertically articulated curricula", is the basis of this research.


Robert P. Van Tries, Assistant Commissioner
DIVISION OF VOCATIONAL-TECHNICAL EDUCATION

DEFINITIONS

Program Area - A general grouping of several related occupations (e.g. auto mechanics is a program area).

Occupational Program - A specific vocational offering designed to help a student learn to perform tasks needed by the worker on-the-job (e.g. service station attendant and brake specialist are the titles of two occupational programs).

Task List - A list consisting of each task (complete element of work) which a student needs to learn to perform if he/she is to be a successful worker on-the-job. Job tasks are the basis for vocational instruction.

Competency Record - A "report card" which indicates to students, teachers, parents, and employers that a given student has demonstrated that he/she can perform certain job-related tasks. Competent performance requires the student to apply the proper knowledge and attitudes to the performance of those tasks.

Articulation - A curriculum is vertically articulated when a student can progress from one level to the next higher level of training without experiencing unnecessary gap or overlap in competencies learned.

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CHAPTER I

BACKGROUND OF THE PROJECT

INTRODUCTION

Over the past four years, the Vocational Division of the Minnesota State Department of Education has funded research efforts designed to discover and develop a procedure for (a) developing products (task lists and competency records) which can be used to articulate secondary and post secondary vocational technical curriculum in Minnesota, and (b) developing a process which can be followed by teachers from the same region as they work together to develop articulated curriculum. An articulated curriculum allows a student to move from the secondary level of vocational training (or from on-the-job experience) to the post secondary level of vocational training without having to repeat instruction for learning those tasks already mastered. Likewise, an articulated curriculum provides opportunity for students to acquire more complete training because the tasks to be performed are explicit and instructors are less apt to inadvertently omit the teaching of important content from their occupational programs.

BACKGROUND

This final report is third in a series of three documents, which collectively describe articulation research and development for the years that the project was funded. The final report for 1972-75 was entitled Developing Articulated High School and Post High School Vocational Technical

Curricula in Minnesota. The final report for 1975-76 was entitled Secondary-Post Secondary Curriculum Articulation Project for Vocational Technical Education in Minnesota. This, the third final report, is entitled Statewide Curriculum Articulation Project for Vocational Technical Education in Minnesota.

1974-75

During 1974-75, progress was made toward identifying and validating a procedure for developing those products (task lists and competency records) needed for articulating occupational programs offered in Minnesota's secondary and post secondary vocational technical institutions. During this time span, the procedures developed for producing articulation products (task lists and competency records) emerged from actions taken in auto mechanics occupations and secretarial clerical occupations.

Also, a Handbook for vocational-technical instructors and coordinators was published. The Handbook explains to instructors how they can deliver recommended task-based content to students. Competency based, personalized instruction is advocated in the Handbook.

1975-76

During 1975-76 the goal of the project was to develop and pilot a process for vertically articulating curriculum between the secondary and post secondary levels of vocational technical education throughout the state of Minnesota. This goal included (a) the continued development and validation of a procedure for developing those statewide products (task lists and competency records) needed for articulation and (b) the develop-

ment of a process for teachers and administrators to follow as they utilized the articulation products through working with schools in their region of the state.

During this year, a procedure for developing articulation products was developed, validated and documented in the final report for 1975-76. A regional process for articulation was developed and successfully piloted in automotive mechanics in three pilot sites in Minnesota.

The following publications were developed and printed in 1975-76:

Competency Based Route to Vertical Curriculum Articulation, Automotive Task Lists (3), Terminal Performance Objectives for Competency Based Instruction-Automotive Mechanics Occupations. Diffusion of project goals, information, and products was accomplished through audio/visual media, conference participation in Minnesota and at the National level, person-to-person correspondence, publications of short articles in newsletters and clearing-house bibliographies, and national mailings.

1976-77

This, the third final report in the series of three documents, describes the research and development undertaken during this past year. Approximately \$279,000 of state and federal monies were expended for articulation in Minnesota during 1976-77. This report includes many appendices. Appendix A, B, and E make available three project publications which are critically important to the reader who wishes to understand the articulation process which was researched and developed.

CHAPTER II

PROJECT GOAL AND PROCEDURES

INTRODUCTION

This chapter identifies the goal of the Statewide Curriculum Articulation Project and documents the procedures used in the areas of (I) Research and Development and (II) Service to Local Vocational-Technical Institutions in Minnesota. The project was Managed by Objectives (MBO). Each of the Functions and Objectives within the areas of (I) Research and Development and (II) Service, are discussed in separate sections below.

THE GOAL OF THE PROJECT

The goal of this project during the past year (1976-77) was to develop, validate, and utilize a process for vertically articulating curriculum between secondary and post secondary levels of vocational technical education throughout the state of Minnesota. This goal included both (a) the development and validation of a procedure for developing the statewide products (task lists and competency records) needed for articulation; (b) the development, validation and utilization of a process for administrators and teachers to follow as they use the products to achieve articulation in their regions of the state; and (c) the development and production of publications and in-service training materials needed by instructors involved in curriculum development/articulation.

GENERAL PROCEDURE

The procedure followed to achieve the goal of the project involved first the identification of two major areas of staff responsibility. Those were (I) Research and Development and (II) Service to Local Vocational Technical Institutions in Minnesota. Within those areas of responsibility, functions and objectives were identified so that the project could be Managed by Objectives (MBO). Project MBO's were approved by the Statewide Curriculum Articulation Project Steering Committee, which is composed of 12 secondary and post secondary vocational education administrators from throughout the state, and representatives from the State Department of Education.

AREA I: RESEARCH AND DEVELOPMENT

Seven Functions were identified as areas in which research and development were needed, if curriculum articulation were to be successfully completed. Those functions were as follows:

R & D Function I - Continued development and validation of an articulation process for Minnesota.

The procedure followed to complete this function included the continued operation of three pilot sites in automotive occupations and one pilot site in secretarial clerical occupations during 1976-77. Each pilot site involved secondary and post secondary teachers in regional workshops. A range of 59 to 180 hours was spent in each pilot site. In each region, the number of instructors who participated ranged from 12 to 32. Instructors traveled as far as 130 miles one-way to attend the articulation-pilot workshop sessions. During these workshop sessions teachers

used the developed task listings for automotive occupations and for secretarial clerical occupations to develop terminal performance objectives, enabling objectives, criterion-referenced written test items and criterion-referenced performance test samples. Eight implementation sites for automotive articulation during 1976-77 further validated the process developed for articulation.

R & D Function II - Development of Guidelines for Constructing Criterion Referenced Tests for the Assessment of Student Competency.

The literature was reviewed and examples of criterion-referenced performances and written tests were collected. Ideas were discussed with vocational technical teachers and examples were developed. Two documents were drafted to guide teachers in the pilot sites as they began developing criterion-referenced written tests and performance tests (see Appendices A and B). The documents were utilized in the automotive pilot and implementation sites and drafts of criterion-referenced tests were produced.

R & D Function III - Documentation and Creation of Program Management Strategies for Competency-Based Instruction.

Students entering post-secondary vocational training programs with recognized competencies will need to be scheduled so that they acquire instruction in those areas where they have not previously demonstrated competency. The strategy for scheduling students and teachers has been referred to as the "program management strategy". The procedure followed to complete this function included (a) documentation of those statements of competency that secondary students have recorded on their records, (b) diagramming course/semester assignments at the post secondary level to ascertain which instructor is responsible for teaching each content area,

(c) studying content for prerequisite learning, (d) deciding upon scheduling alternatives and modifications that needed to be made within the current program, and (e) tryout and modification of teacher's choices to include elected competencies in the courses they teach.

R & D Function IV - Development of Criteria for Selecting Content for Exploratory Programs (Cluster Exploration).

Recommendations for fusing career education into existing general business courses were drawn up after (a) critically analyzing the developed task listings for secretarial clerical occupations and (b) interacting with individuals who were in the process of writing a proposal to obtain a grant for developing career education materials for business and office education.

R & D Function V - Development of a Procedure for Determining and Charting Common Avenues of Worker Mobility Within a Given Program Area.

The literature was reviewed and special attention paid to possible ways of graphically portraying common avenues of worker mobility within the areas of secretarial clerical occupations, food service occupations and accounting occupations.

Verbal descriptions of mobility patterns were studied through acquisition of job descriptions written in industry, and the task listings were developed to include mobility information when appropriate.

R & D Function VI - Investigation of Procedures for Updating Articulation Products.

Sources of data that could be used for updating articulation products were identified through the use of bibliographies, clearinghouse releases,

and professional contacts, both in industry and education. Samples of data-gathering instruments were collected.

R & D Function VII - Acquisition of Findings in Related Research and Development on a Nationwide Basis to Establish a Knowledge Base for All Project R & D Functions.

Sources of related research findings were identified through ERIC, AIM/ARM, TIE (Task Inventory Exchange), professional associations, newsletters, commercial bulletins, displays at professional conferences and professional contacts with persons conducting similar curriculum efforts in other states. Participation of staff members in workshops and upgrading experiences which were related to project goals and activities also helped to establish a knowledge base for all project R & D functions.

R & D Function VIII - Participation in Project Information/Dissemination/Diffusion Nationwide.

The procedure for completing this function has been (a) formal presentations at state and national meetings, (b) written and verbal communication with individuals and agencies that requested information or showed interest in the project, (c) announcement of project publications and services in local directories, newsletters, and clearinghouses, and (d) national mailings of project publications and reports.

AREA II: SERVICE

Concomitant with the generation of new ideas, information and methods, the Statewide Curriculum Articulation Project also provided services to the state of Minnesota. This past year seven functions were identified within the service area. Each is discussed in the sections which follow.

Service Function I - Statewide Articulation of Auto Mechanics Occupations.

Auto mechanics articulation sessions were provided through separate grant awards from the State Department of Education to eight regional sites in Minnesota. Actions taken in each of the eight sites were directed by Statewide Curriculum Articulation Project staff. The articulation workshop sessions included teachers from both the secondary and post secondary levels. Teachers from schools within each self-declared region met at a central location for approximately forty (40) hours of working time together. The size of regions varied from ten (10) to thirty-five (35) secondary and post secondary participants. Most sessions were held after school at night or on Saturdays. Teachers drove as far as 190 miles one-way to attend the sessions. The articulation process used in each regional site is described in the project publication entitled An Articulation Process Manual for Administrators and Project Consultants-on-Site, (see Appendix c). Table 4 shows the amount of grant awards provided to each applicant post secondary vocational-technical institute for auto mechanics articulation during 1976-77. When more than one post secondary institution participated with surrounding secondary institutions in the declared region, the names of those post secondary schools appear in parenthesis. Accurate records of teacher participation were kept for each region, and application for clock hour recertification credit was made to appropriate state supervisors by those teachers who attended the sessions. Reimbursement for travel expenses and minimal compensation for teacher participation in articulation sessions was provided through the grant awards.

Grant Award Receiver	Total	Beginning Date	Ending Date
Rochester	\$ 5,800.00	3/31/76	3/31/77
	\$ 4,100.00	3/31/76	6/30/77
	\$ 4,000.00	2/7/77	6/30/77
Duluth	\$ 5,672.00	6/8/76	6/30/77
	\$ 912.00	2/7/77	6/30/77
East Grand Forks (Thief River Falls)	\$ 12,312.00	5/3/76	6/30/77
Brainerd (Pine City, St. Cloud, Wadena)	\$ 12,633.00	11/1/76	6/30/77
Hibbing (Eveleth)	\$ 14,550.00	11/1/76	6/30/77
Hutchinson	\$ 5,842.25	11/1/76	6/30/77
Willmar	\$ 10,315.50	11/1/76	6/30/77
Mankato (Albert Lea, Austin)	\$ 15,990.801	1/1/77	6/30/77

Table 1

Regional grant awards for auto mechanics articulation during 1976-77.

Service Function II - Development of Articulation Products (Task
Lists and Competency Records) in Accounting-Bookkeeping Occupations.

The procedure followed to complete this function involved the following sequence of action: Industry representatives from throughout the state were interviewed to determine job titles, job descriptions, and job content. Individual instructors of bookkeeping and accounting programs reacted to the task list and added their suggestions prior to the group meetings between industry representatives and secondary and post secondary instructors throughout the state. The task lists were put in the proper format and a competency record and rating scale was decided upon. The task lists were developed to reflect the tasks performed by workers in both manual accounting and computerized accounting systems.

Task lists and competency records were developed for the following Accounting-Bookkeeping Occupations:

Accounting Clerk

Accounts Receivable Clerk

Accounts Payable Clerk

Inventory Clerk

Billing/Invoicing Clerk

Purchasing Clerk

Cash Receipts Clerk

Cash Disbursements Clerk

Bookkeeper

Cost Accounting Clerk

Payroll Clerk

Accountants: Public and Private

Service Function III - Development of Articulation Products in Food

Service Occupations.

Task list and competency records were developed for the following food service occupations:

Set A: Waiter/Waitress (including Host/Hostess)

Cashier

Bus Person

Counter Worker (Fast/Service Restaurant)

Set B: Cook/Chef

Short Order Cook

Kitchen Assistant

Set C: Baker

Bakery Salesperson

The task list developmental process involved a working committee of teachers and industry representatives from throughout the state who made decisions concerning (1) appropriate occupational titles, (2) job descriptions, and (3) the tasks which should be performed by a worker in each occupation. A subject-matter consultant (See Appendix C) was employed by the project to assist in developing and refining the task lists and competency records. The working committee of instructors made decisions about the format and rating scale for the competency record.

Service Function IV - Development of Articulation Products in Construction

Trades Occupations.

Within the Construction Trades area a task list and competency record was developed for the occupational program entitled carpenter. This task list was developed cooperatively by a working committee of instructors and

and a committee of industry and union representatives from throughout the state who made decisions concerning (1) occupational titles appropriate for vocational training, (2) content of the job description, and (3) the tasks which a carpenter must perform. A subject-matter consultant (see Appendix C) was employed by the project to assist in developing and refining the Task List and Competency Record. The working committee of instructors was responsible for determining the format and rating scale for the competency record.

Service Function V - Development of In-Service Procedures Which Will Allow Schools That Were Not Initially Involved in Pilot Articulation Efforts to Join Ongoing Articulation Efforts.

Within the Auto Mechanics pilot sites, instructors were identified who had not participated in the initial regional articulation sessions. The inservice for new instructors joining the regional effort involved providing them with materials and explanation of how to use the materials developed by the group. This included an explanation of how to use the materials developed by the group. This included an explanation of the task lists, the terminal performance objectives, the enabling objectives, the testing procedures, the grading of the competency records, and the content decided upon by the group for inclusion in the secondary programs.

Function VI - Cooperation with Minnesota Teacher Educators.

Information on project products, processes, and task list development meeting dates was mailed to interested teacher educators and teacher education inservice coordinators in Trade and Industrial Education, Business and Office Education, Home Economics Education, and Distributive Education. Schedules of meeting dates, times, and places were mailed as soon as grant

awards were made to regional sites. Requests for project publications were filled and presentations were given to groups of teacher educators both at state conferences and to individuals who came to the headquarters office.

CHAPTER III

EVALUATION OF THE PROJECT GOAL

INTRODUCTION

This chapter addresses itself to the extent to which the stated goal of the Statewide Curriculum Articulation Project was reached. The goal for 1975-77 was to develop, validate, and utilize a process for vertically articulating curriculum between the secondary and post secondary levels of vocational technical education throughout the state of Minnesota. This goal included (a) the development and validation of a procedure for developing those articulation products (task lists and competency records) needed for articulation, (b) the development, validation, and utilization of a regional process for teachers and administrators to follow as they utilize the articulation products developed for vocational education throughout the state of Minnesota, and (c) the development and production of publications and inservice training materials needed by instructors who were involved in the curriculum development/articulation process.

Formative evaluation was an important part of this developmental research effort in that many pieces of data were formally and informally gathered, used, and re-evaluated as the developmental process continued. The success of this research and development effort was to be determined by whether or not the process developed for articulation promoted communication and cooperation among secondary and post secondary vocational instructors. Evidence of improved communication and cooperation was teacher

attendance and participation in the scheduled articulation meetings held in their region of the state.

EVALUATION - PRODUCT DEVELOPMENT

A procedure for developing articulation products (task lists and competency records) on a statewide basis was developed, validated and utilized in the following program areas: auto mechanics occupations, secretarial/clerical occupations, food service occupations, construction occupations, and accounting occupations. In all instances the procedure was reasonable in cost and efficient in terms of the length of time required to produce the task lists and competency records for each program area. Articulation products (task lists and competency records) were developed and printed this past year for 12 secretarial/clerical occupations, nine food service occupations, one construction trades occupation, and three levels of accounting occupations. The basic procedure utilized to develop each of the task lists is noted in Chart 2. The titles of the task list booklets have been cited in the second chapter of this report.

PROCEDURE FOR DEVELOPING TASK LISTS
FOR OCCUPATIONAL PROGRAMS IN MINNESOTA

1. Resources (task lists, performance objectives, etc.) are collected for project use.
2. A subject matter consultant for the occupational program area is identified, hired and oriented to the project goals and resources.
3. A first draft of the task list for the entire program area is constructed, after thorough review of all resources and after having interviewed a number of teachers throughout the state.
4. Instructors from throughout Minnesota are identified to make up a WORKING COMMITTEE. Program supervisors at the State Department of Education suggest names of individuals who would be effective on this committee.
5. A large number of vocational teachers are surveyed to determine job titles commonly assumed by graduates of the program areas.
6. Tentative titles for occupational programs are decided upon and tentative job descriptions are written. Separate task lists for each occupational program area can then be developed by the working committee, project staff and the state supervisors for that program area.
7. The draft of each task list is submitted to a committee of industry representatives from throughout Minnesota. This meeting is at least one day long. The purpose of the meeting is to bring together employers who are in charge of hiring, firing, supervising, and promoting employees. In the presence of the working committee, industry representatives are asked to respond to the range of occupational programs offered, to judge the adequacy of the number and description of tasks suggested on each task list, and to point out the tasks they feel are "optional" and those tasks that are "very important" for the student to be able to perform upon taking the job described in the job description. The competency record is reviewed by industry representatives to determine whether or not modifications are needed to adequately communicate student performance to prospective employers.
8. The task lists and competency records for each approved occupational program is printed in booklet form. These products are then made available to secondary and post secondary instructors in Minnesota for the purpose of CURRICULUM ARTICULATION.

CHART 1

The system for updating task lists and competency records was developed with the intention of continually bringing industry and education closer together in their perceptions of what a competent graduate is to be able to do upon becoming employed. This year data were gathered to update and revise the auto mechanics task lists that were printed during 1975-76. The data gathering procedures included instructor reaction and revision of task statements as they utilized the automotive mechanics task lists in each of the eight regional articulation sites. Notes were kept of the changes needed in the task lists and discussion of changes took place at the Statewide Curriculum Articulation Project auto mechanics committee meeting held during May.

In the years to come, periodic meetings between the working committee of instructors and industry representatives as the state level should be combined with input from local advisory committees. The task lists should be revised and updated every one or two years to stay current with the technological advances in industry. The procedure for updating the task lists becomes an integral part of the procedure developed by the Statewide Curriculum Articulation Project for producing those products (task lists and competency records) needed for articulation.

EVALUATION - PROCESS DEVELOPED FOR ARTICULATION

The second goal of the project was to develop, validate, and utilize a process for teachers and administrators to follow as they articulate secondary and post secondary curriculum. A regional approach to articulation was taken. During 1976-77 eight regional sites were operated for auto mechanics articulation and one site for secretarial/clerical occupations.

A report of the cost-benefit of articulation to the State of Minnesota needs to include data showing the effect of adopted curriculum changes upon the quality of educational opportunities compared to the quality and quantity of opportunities that were available to students, at the taxpayer's expense, prior to articulation. Decisions to continue articulation of secondary and post secondary vocational technical curriculum are presently based upon the strong support for the effort as a means of achieving optimal programming at both the secondary and post secondary levels. Support for the articulation effort has been evidenced by "the repeated contributions of time and energy made by teachers". Most of the sessions were held on weekday evenings and Saturdays. Teachers were paid token honorariums amounting to less than \$5.00 per hour for participating in the sessions.

During this past year, each site consultant¹ kept records of teacher attendance at his/her regional articulation sessions (see Tables 2 - 10). The attendance records provided evaluative data which were interpreted as positive teacher feedback in regard to the worth of the curriculum articulation process.

¹Names of project consultants-on-site for each region appear in Appendix D.

Grant Award Receiver: Rochester AVTI (\$13,900.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	172	172
Instructor B (ps)	158½	172
Instructor C (ps)	115	172
Instructor D (ps)	33	33
Instructor E (ps)	25	25
Instructor F (ps)	27	27
Instructor G (s)	90½	90½
Instructor H (s)	33	39
Instructor I (s)	75	76½
Instructor J (s)	86	86
Instructor K (s)	74	80
Instructor L (s)	66½	85
Instructor M (s)	37½	37½
Instructor N (s)	77	88
Instructor O (s)	47	47
Instructor P (s)	73	88
Total Number of Participants 16	Person 1189.5 Hours	Possible Session 1410 Hours
	$\frac{1189.5}{1410} = 84\% \text{ Attendance}$	

Table 2

Teacher attendance at automotive articulation sessions held in Rochester, Minnesota, 1976-77.

Grant Award Receiver: Duluth AVTI (\$6,584.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	110	110
Instructor B (ps)	103	110
Instructor C (ps)	103	110
Instructor D (s)	76	76
Instructor E (s)	76	76
Instructor F (s)	76	76
Instructor G (s)	76	76
Instructor H (s)	65	76
Instructor I (s)	43	43
Instructor J (s)	40	40
Total Number of Participants 10	Person 768 Hours	Possible Session 793 Hours
$\frac{768}{793} = 98\% \text{ Attendance}$		

Table 3

Teacher attendance at automotive articulation sessions held in Duluth, Minnesota, 1976-77.

Grant Award Receiver: East Grand Forks AVTI (\$12,312.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	55½	59
Instructor B (ps)	59	59
Instructor C (ps)	56	59
Instructor D (ps)	19½	59
Instructor E (ps)	39½	59
Instructor F (ps)	30½	59
Instructor G (s)	59	59
Instructor H (s)	44	59
Instructor I (s)	50	59
Instructor J (s)	16½	59
Instructor K (s)	39½	59
Instructor L (s)	49½	59
Instructor M (s)	20	59
Instructor N (s)	19½	19½
Instructor O (s)	17½	17½
Instructor P (s)	7½	7½
Total Number of Participants 16	Person 582 Hours	Possible Session 811.5 Hours
$\frac{582}{811.5} = 72\% \text{ Attendance}$		

Table 4

Teacher attendance at automotive articulation sessions held in East Grand Forks, Minnesota and Thief River Falls, Minnesota, 1976-77.

Grant Award Receiver: Mankato AVTI (\$15,990.80)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	172	172
Instructor B (ps)	158½	172
Instructor C (ps)	115	121
Instructor D (ps)	33	33
Instructor E (ps)	25	25
Instructor F (ps)	27	27
Instructor G (s)	90½	90½
Instructor H (s)	33	39
Instructor I (s)	75	76½
Instructor J (s)	86	86
Instructor K (s)	74	80
Instructor L (s)	66½	85
Instructor M (s)	37½	37½
Instructor N (s)	77	88
Instructor O (s)	47	47
Instructor P (s)	73	88
Total Number of Participants 16	Person 1189.5 Hours	Possible Session 1410 Hours
$\frac{965}{1092} = .88 \text{ Attendance}$		

Table 5

Teacher attendance at automotive articulation sessions held in Mankato,
Minnesota, 1976-77.

Grant Award Receiver: Willmar AVTI (\$10,315.50)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	56	56
Instructor B (ps)	56	56
Instructor C (ps)	48	56
Instructor D (ps)	44	56
Instructor E (s)	48	56
Instructor F (s)	8	56
Instructor G (s)	0	0
Instructor H (s)	56	56
Instructor I (s)	32	56
Instructor J (s)	32	56
Instructor K (s)	40	56
Instructor L (s)	52	56
Instructor M (s)	32	56
Instructor N (s)	0	0
Instructor O (s)	40	56
Instructor P (s)	40	56
Instructor Q (s)	56	56
Instructor R (s)	0	0
Instructor S (s)	48	56
Instructor T (s)	40	56
Instructor U (s)	0	0
Instructor V (s)	0	0
Instructor W (s)	56	56
Instructor X (s)	40	56
Total Number of Participants 19	Person 824 Hours	Possible Session 1064 Hours
$\frac{824}{1064} = 77\% \text{ Attendance}$		

Table 6

Teacher attendance at automotive articulation sessions held in Willmar,
Minnesota, 1976-77.

Grant Award Receiver: Hibbing AVTI (\$14,550.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	57	63
Instructor B (ps)	20	63
Instructor C (ps)	16	63
Instructor D (ps)	60	63
Instructor E (ps)	60	63
Instructor F (s)	7	56
Instructor G (s)	56	56
Instructor H (s)	7	56
Instructor I (s)	49	56
Instructor J (s)	56	56
Instructor K (s)	56	56
Instructor L (s)	53	56
Instructor M (s)	23	56
Instructor N (s)	28	56
Instructor O (s)	29	56
Instructor P (s)	0	0
Total Number of Participants 15	Person 577 Hours	Possible Session 875 Hours
	$\frac{577}{875} = 66\% \text{ Attendance}$	

Table 7

Teacher attendance at automotive articulation sessions held in Hibbing, Minnesota and Eveleth, Minnesota, 1976-77.

Grant Award Receiver: Hutchinson AVTI (\$ 5,842.25)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	52½	52½
Instructor B (ps)	52½	52½
Instructor C (s)	52½	51½
Instructor D (s)	52½	52½
Instructor E (s)	52½	52½
Instructor F (s)	52½	52½
Instructor G (s)	52½	52½
Instructor H (s)	49	52½
Instructor I (s)	35	52½
Instructor J (s)	49	52½
Instructor K (s)	49	52½
Total Number of Participants 11	Person 549.5 Hours	Possible Session 577.5 Hours
$\frac{549.5}{577.5} = 95\% \text{ Attendance}$		

Table 8

Teacher attendance at automotive articulation sessions held in Hutchinson, Minnesota, 1976-77.

Grant Award Receiver: Brainerd AVTI (\$15,447.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	56	56
Instructor B (ps)	56	56
Instructor C (ps)	35	56
Instructor D (ps)	21	56
Instructor E (ps)	42	56
Instructor F (ps)	56	56
Instructor G (ps)	35	56
Instructor H (ps)	14	56
Instructor I (ps)	42	56
Instructor J (ps)	28	56
Instructor K (ps)	56	56
Instructor L (ps)	42	56
Instructor M (ps)	56	56
Instructor N (ps)	42	56
Instructor O (ps)	42	56
Instructor P (s)	49	56
Instructor Q (s)	31.5	56
Instructor R (s)	49	56
Instructor S (s)	42	56
Instructor T (s)	42	56
Instructor U (s)	56	56
Instructor V (s)	7	56
Instructor W (s)	52.5	56
Instructor X (s)	42	56
Instructor Y (s)	49	56
Instructor Z (s)	56	56
Instructor AA(s)	35	56
Total Number of Participants 27	Person 1120 Hours	Possible Session 1512 Hours
$\frac{1120}{1512} = 74\% \text{ Attendance}$		

Table 9

Teacher attendance at secretarial clerical articulation sessions held in
Brainerd, Minnesota, 1976-77.

Grant Award Receiver: Bemidji AVTI (\$12,175.00)

Instructor s = secondary ps = post secondary	Hours in Attendance	Hours of Session Time
Instructor A (ps)	71	71
Instructor B (ps)	63	71
Instructor C (ps)	71	71
Instructor D (ps)	63	71
Instructor E (ps)	71	71
Instructor F (s)	63	71
Instructor G (s)	71	71
Instructor H (s)	71	71
Instructor I (s)	41	71
Instructor J (s)	71	71
Instructor K (s)	68	71
Instructor L (s)	71	71
Instructor M (s)	63	71
Instructor N (s)	68	71
Instructor O (s)	71	71
Instructor P (s)	71	71
Instructor Q (s)	71	71
Instructor R (s)	68	71
Instructor S (s)	62	71
Instructor T (s)	71	71
Instructor U (s)	71	71
Instructor V (s)	71	71
Instructor W (s)	45	71
Instructor X (s)	51	71
Instructor Y (s)	71	71
Instructor Z (s)	63	71
Instructor AA(s)	60	71
Instructor BB(s)	52	71
Instructor CC(s)	71	71
Instructor DD(s)	68	71
Instructor EE(s)	68	71
Total Number of Participants 31	Person 2031 Hours	Possible Session 2201 Hours
$\frac{2031}{2201} = 88\% \text{ Attendance}$		

Table 10

Teacher attendance at secretarial clerical articulation sessions held in Bemidji, Minnesota, 1976-77.

It can be concluded that teacher attendance at articulation sessions was high. Attendance is presented as evidence of positive teacher feedback regarding the worth of the curriculum articulation sessions to them as professionals.

EVALUATION

PUBLICATIONS AND IN-SERVICE TRAINING MATERIALS

The third goal of the project was to develop and produce publications and in-service training materials needed by instructors who were involved in the curriculum development/articulation process.

Publications developed, printed, and field-tested this year for the purpose of guiding teachers in making decisions during articulation sessions included:

Competency Assessment: A Vocational Instructor's Guide to Developing Written Tests, (Appendix A).

Competency Assessment: A Vocational Instructor's Guide to Developing Performance Tests, (Appendix B).

The Articulation Process Manual for Administrators and Project Consultants-on-Site, (Appendix E).

The appendices of this final report include the preceding three publications. A complete listing of all products developed to date by the articulation project(s) during the three years that these research and development projects have been funded, are included in Appendix D. Most publications are available through the Minnesota Instructional Materials Center, 3554 White Bear Avenue, White Bear Lake, Minnesota, 55110, on a cost-recovery or free loan basis.

Diffusion of project findings and products has been accomplished through presentation at state and national conferences. Secondary and post secondary directors, vocational instructors and teacher educators have been updated on project actions through presentations at regularly scheduled meetings. Articles have been written for journals and newsletters, both at the national and state levels. Listings of articulation project products have appeared in clearinghouse bibliographies. Selected project publications and final reports have been disseminated through national mailings on a regular basis. Person-to-person correspondence has been initiated and responded to in an attempt to diffuse project findings and to benefit from similar efforts nationwide.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

As a result of project research and development activities this past year, several conclusions and recommendations can be made. The recommendations made in this chapter refer to the management of curriculum articulation activities within the State of Minnesota in future years. These recommendations are made after consideration was given to current roles, responsibilities, and concerns of state and local employees within Minnesota's vocational system.

CONCLUSIONS

It can be concluded that a procedure for developing articulation products for use statewide has been developed, validated, and successfully used in five program areas (auto mechanics, secretarial/clerical, food service, construction trades - carpentry, and accounting occupations.) The products were utilized on a regional basis, according to a documented articulation process. That process has been successfully used in eight regional automotive sites and one regional secretarial/clerical site. Although minor modifications may need to be made as the process is used for articulation in future years, the guidelines are basic and generalizable. The procedure used to develop products (task lists and competency records) is designed to bring industry and education closer together through periodic data-gathering of job tasks. Task based programs can then stay current with technological advances.

This research and development project has purposely documented a system for curriculum development which can be used for articulation of all program areas. Rather than attempting to provide a recipe for articulation in each unique program area (e.g. food service occupations, drafting occupations, etc.) this research and development project has been based upon the assumption that subject matter areas of vocational technical education² are more unified than diverse in their needs, concerns, goals and values.

RECOMMENDATIONS

Curriculum articulation, when it occurs according to the process described, provides the structure needed for a curriculum development system for the state of Minnesota. The system can be used on a continuing basis to update, revise, and impact upon the quality of vocational technical curriculum throughout the state. The system can contribute to program planning by providing data to be interpreted at the state level.

If such a statewide curriculum development system is found desirable, it is recommended that the administration of it be carefully planned and coordinated. It is recommended that the State Department of Education, with the help of an advisory committee representative of vocational education in Minnesota, re-evaluate and carefully delimit the roles and responsibilities of Vocational Division agencies and employees. Then, assuming that such a curriculum development system were adopted, the

² *Subject matter areas of vocational technical education are: agriculture, home economics, business and office, distributive education, health occupations, and trade and industrial education.*

responsibilities of the individual(s) managing the system would need to be described. Decisions made by the individual(s) managing the curriculum development system should be firmly based upon the advice of an advisory board. Such an advisory board would give a broad decision-making base for the administration of public funds.

It is recommended that vocational curriculum development first be seen in a generic sense and that program areas be given specific attention as they are accommodated within the curriculum development system. This approach would result in a unified effort with consistent direction and the added capability of utilizing knowledge gained in one program area to strengthen other areas.

Five specific recommendations have emerged from the Statewide Curriculum Articulation Project this year. They are as follows:

Recommendation #1:

A representative survey of vocational educators should be made to establish the existence of the project on a continuing basis. Sufficient evidence of project process and progress is available to decision makers. The emergence of a curriculum development system in Minnesota should be made by choice not by evolution.

Recommendation #2:

An Advisory Board should be established to give a broad decision-making base to the project. Without a strong Board, actions could be based upon unilateral decisions which are subject to fluctuations in the political climate rather than objectively identified needs and the prioritizing of those needs.

Recommendation #3:

A curriculum development system requires one underlying rationale and process with variations occurring after careful consideration is given to the subject matter characteristics of the unique program areas involved. For this reason, it is recommended that clear-cut lines of authority and responsibility be established for the administration of public funds. This would ensure that an inordinate amount of time not be spent in deciding upon who is responsible for what decisions. Responsibility for data gathering interpretation and presentation to the Advisory Board should be established. Authority to act upon Board decisions should be delegated to State agencies and employees through a written policy document which deals specifically with curriculum development for vocational technical education in Minnesota. A long-range plan should be developed within the next year.

Recommendation #4:

The issue of horizontal articulation between vocational service areas should be given special attention within the curriculum articulation process. A complete analysis of program areas should be made to identify both the exploratory and occupational content that is common to two or more program areas. Teachers of those program areas with overlapping content should be included in the task development process and the regional articulation activities.

Recommendation #5:

Continual attention should be given to the research and development functions of the Statewide Curriculum Articulation Project, so that leadership in curriculum development will be available in Minnesota. Research and development is recommended in the areas of (1) criterion-referenced

testing, (2) program management strategies for competency-based instruction, (3) developing the long-range plan and (4) designing patterns of coordination for state agencies and employees now concerned with curriculum development and delivery of curriculum services to vocational technical education in Minnesota.

SUMMARY OF THE REPORT

Time Covered by the Report -

July 1, 1976 through June 30, 1977.

Goal of the Project -

The goal of this project was to develop, validate, and utilize a process for vertically articulating curriculum between secondary and post secondary levels of vocational technical education throughout the State of Minnesota. This goal included both (a) the development and validation of a procedure for developing those statewide products (task lists and competency records) needed for articulation, (b) the development, validation and utilization of a process for administrators and teachers to follow as they used the products to achieve articulation in their regions of the state, and (c) the development and production of publications and in-service training materials needed by instructors who were involved in curriculum development/articulation.

Procedures Followed -

The procedure followed to achieve the goal of the project involved first the identification of two areas of staff responsibility. Those were (I) Research and Development and (II) Service to Local Vocational Technical Institutions in Minnesota. Within those areas of responsibility, functions and objectives were identified and delimited so that the project could be Managed by Objectives (MBO). Project MBO's were approved by the Statewide Curriculum Articulation Project Steering Committee and Representatives from the State Department of Education.

Results and Accomplishments -

A procedure for developing articulation products (task lists and competency records) on a statewide basis was developed, validated, and utilized in the following program areas: auto mechanics occupations, secretarial/clerical occupations, food service occupations, construction occupations and accounting occupations.

A process for teachers and administrators to follow as they articulate secondary and post secondary curriculum was developed, validated, and utilized. During 1976-77 eight regional sites were operated for auto mechanics articulation and one site for secretarial/clerical occupations.

Publications were developed, printed and field-tested for the purpose of guiding teachers in making decisions during articulation sessions. Three such publications are included as appendices of this final report. Many other project publications are to be made available on a cost-recovery basis. A complete listing of publications is contained in Appendix D.

Conclusions and Recommendations -

This research and development project has documented a system for curriculum development which can be used for articulation of all vocational technical program areas. The system can be used on a continuing basis to update, revise and impact upon the quality of vocational technical curriculum throughout the state. An active advisory board would be necessary to give a broad decision-making base for the administration of public funds.

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APPENDIX A

COMPETENCY ASSESSMENT:

A Vocational Instructor's Guide to Developing

PERFORMANCE TESTS



Statewide Curriculum Articulation Project
for Vocational Education
3584 White Bear Avenue
White Bear Lake, Minnesota 55110

CONSTRUCTING PERFORMANCE TESTS

A performance test is a test in which the conditions of performance are designed to match as closely as possible the actual conditions under which the tasks are performed on-the-job.

A performance test is given for the purpose of documenting whether or not a student is competent at performing a task (or group of tasks) which is (are) essential to his/her success on-the-job. If a student does not perform successfully on the test, the information the teacher obtains can be useful in diagnosing why the student is unable to perform satisfactorily and it also is useful for identifying possible deficiencies in the instructional program. The basic steps of performance test construction are listed and explained in this booklet. Teachers from the same region can work together and develop standardized performance tests that can then be administered and scored by any instructor.

The following steps should be completed in preparing a performance test. The basic steps are listed below and more detailed information on each step appears on the following pages.

1. DETERMINE THE COMPETENCY STATEMENT FOR WHICH THE PERFORMANCE TEST IS TO BE CONSTRUCTED.
2. DETERMINE HOW TO CREATE CONDITIONS THAT WILL ALLOW THE PERFORMANCE TEST TO BE REALISTIC.
3. DECIDE WHETHER THE STUDENT'S PERFORMANCE CAN BEST BE EVALUATED BY ASSESSING (A) THE PRODUCT, (B) THE PROCESS, OR (C) BOTH THE PRODUCT AND THE PROCESS.
4. MAKE A LIST OF NECESSARY TOOLS, EQUIPMENT, AND SAFETY PRECAUTIONS.
5. WRITE THE DIRECTIONS TO THE STUDENT.
6. WRITE THE DIRECTIONS TO THE TEST ADMINISTRATOR.
7. PREPARE A CHECKLIST OR RATING SCALE WHICH CAN BE USED TO EVALUATE THE PROCESS FOLLOWED AND/OR THE PRODUCT PRODUCED BY THE STUDENT.
8. TRY OUT THE PERFORMANCE TEST WITH A FEW STUDENTS OR WORKERS AND MAKE THE NEEDED REVISIONS.

BACKGROUND INFORMATION NEEDED TO ACCOMPLISH STEP 1

STEP 1: DETERMINE THE COMPETENCY STATEMENT FOR WHICH THE PERFORMANCE TEST IS TO BE CONSTRUCTED

To complete STEP 1, it will be helpful to first clarify what is meant by a competency, a task listing, and a competency record.¹ If you are familiar with these terms, you may wish to go directly to page 5.

A cluster or grouping of several tasks is called a competency statement. It is frequently the terminal performance expected of the worker or student. A competency statement is large enough to have practical meaning to an employer, that is, it tells the employer what the student can do. In example A, three competency statements which tell the performances required of a flight attendant are listed.

OCCUPATION:	<u>FLIGHT ATTENDANT</u>
Competency Statement:	Perform boarding duties to prepare passengers for the flight
Competency Statement:	Conducts pre-boarding check to assure necessary procedures are followed
Competency Statement:	Gives Crew briefing in compliance with federal air regulations

Example A
Competency Statements

A task is a complete element of work performed by a worker or student. When a worker or a student has demonstrated successful performance of the related job tasks, and has applied the correct knowledge to the performance of those tasks, the corresponding competency statement is graded for the student. Job tasks are the basis for vocational instruction. In Example B, there are four tasks which make up the competency statement "Performs Boarding Duties To Prepare Passengers For The Flight".

OCCUPATION:	<u>FLIGHT ATTENDANT</u>
COMPETENCY:	<u>PERFORMS BOARDING DUTIES TO PREPARE PASSENGERS FOR THE FLIGHT</u>
Tasks:	1. Greets passengers 2. Assists with baggage 3. Conducts head count 4. Makes announcements

Example B
Competency Statements With Tasks

¹ Definitions and examples for the terms competency statement, tasks, and competency record are from Competency Based Route to Vertical Curriculum Articulation.

A task listing is simply a complete listing of all the tasks (organized under competency statements) which a worker in a specific occupation must be able to perform.

A competency record is a form which is used to record a student's final performance. The Competency Record identifies exactly what the student can or cannot do. It is generally used to replace or supplement the traditional report card.

A Student Competency Record for the occupation Flight Attendant could be similar to Example C below.

COMPETENCY RECORD OCCUPATION: FLIGHT ATTENDANT					
Name of Student _____			Instructor _____		
Name of School _____					
The checks on this competency record tell what this student has demonstrated that he or she can do. An advisory committee representing industries throughout Minnesota has assisted in establishing this list of what a student should be able to do as a worker in this occupation.					
			Secondary Grade Year Teacher	Post Secondary Grade Year Teacher	
AREA OF COMPETENCY #1: EMERGENCY PROCEDURES					
IA. Maintains emergency equipment					
IB. Follows safety regulations					
IC. Observes evacuation procedures					
ID. Performs first aid duties					
AREA OF COMPETENCY #2: PRE-FLIGHT DUTIES					
IA. Gives crew briefing					
IB. Attends crew briefing					
IC. Conducts pre-boarding check					
ID. Performs boarding duties					
AREA OF COMPETENCY #3: IN-FLIGHT DUTIES					
IA. Prepares and serves meals					
IB. Performs customer service					
IC. Conducts air shuttle service					
AREA OF COMPETENCY #4: POST-FLIGHT DUTIES					
IA. Performs arrival duties					
IB. Performs in-terminal duties					

Example C
Competency Record

STEP 1: DETERMINE THE COMPETENCY FOR WHICH THE PERFORMANCE TEST NEEDS TO BE CONSTRUCTED.

Refer to the COMPETENCY RECORD to determine the competency statement for which the student should receive a grade. Read the TASK LIST (which is a companion to the COMPETENCY RECORD) for the occupational program. The task list clarifies which tasks are included in the competency statement when specific information is needed. Add to the competency statement two things:

- a. the statement of the conditions which will surround the student's performance, and
- b. the minimum level of acceptable performance.

Now the competency statement is the same as the terminal performance objective. In Example D below, the conditions and minimal level of acceptable standards have been added to the competency statement "performs boarding duties". This has already been done if you participated in the Regional Articulation sessions for secondary and post secondary schools in your region of Minnesota.

OCCUPATION:	<u>FLIGHT ATTENDANT</u>
<u>Competency Statement:</u>	Performs boarding duties
<u>Conditions:</u>	Passengers with baggage boarding airplane
<u>Minimal Level of Acceptable Performance:</u>	Passengers greeted according to airline standards, baggage stored according to carry-on baggage regulations, passenger head count corresponds with master list of passengers, routine announcements made according to airline standards.

Example D
Terminal Performance Objective

STEP 1 (Continued)

Refer to the terminal performance objective(s) that have been written for each competency statement on the TASK LIST, and select the critical tasks which need to be evaluated by a performance test. It is desirable to develop a performance test for each competency statement on the TASK LIST; however, this may not always be possible. It may be necessary to select the most critical tasks to evaluate with a performance test or to select those tasks which are the most representative of the competency to be evaluated. When selecting those performances to be evaluated, it is helpful to consider the following guidelines:

1. Select tasks which are especially difficult or crucial to correct performance.
2. Select tasks which do not involve a great deal of repetition of identical procedures.
3. Eliminate easy, routine tasks that most students perform correctly.
4. Consider practical limitations such as length of time, amount of equipment and personnel required for evaluation.
5. Include tasks which are often responsible for on-the-job failure when performed incorrectly.

STEP 2: DETERMINE HOW TO CREATE CONDITIONS THAT WILL ALLOW THE PERFORMANCE TEST TO BE REALISTIC.

A performance test was defined earlier in this booklet as "a test in which the necessary conditions for performing a group of tasks are designed to match as closely as possible the actual conditions under which the tasks are performed on the job". If a performance test is to be useful, it must be as representative of "real life" performance as is possible.

In most cases, the terminal performance objectives call for the use of job-relevant equipment, environment, facilities, personnel or time constraints that can be duplicated. However, there are situations where the conditions required may exceed the resources available at the school. In these situations the instructor must analyze how critical the objective is to successful performance and the cost involved in obtaining complete realism of testing conditions. When the specified test conditions cannot be duplicated, the instructor must develop alternative testing conditions that are representative of "real-life" performance. Often the test conditions can be simulated to represent the actual conditions.

In making decisions concerning realistic test conditions the following items should be considered:

1. Physical environment - furniture, equipment, light, heat, sound, terrain.
2. The time required for the performance.
3. The people normally involved in the performance.
4. The cues or prompts that initiate the performance.
5. The cost involved in obtaining the actual or simulated conditions.
6. The risk or danger involved in the actual performance.

STEP 3: DECIDE WHETHER THE STUDENT'S PERFORMANCE CAN BEST BE EVALUATED BY ASSESSING (A) THE PRODUCT, (B) THE PROCESS, OR (C) BOTH THE PRODUCT AND THE PROCESS.

A PRODUCT may be defined as a tangible outcome which results from performance of a task or tasks. A PROCESS refers to the procedure used to obtain the desired product or outcome. Sometimes the PRODUCT which results from correct performance of tasks is the primary consideration when evaluating performance. At other times, the PROCESS used is the major focus of the evaluation. There are also many situations in which both the PRODUCT and the PROCESS are important to the evaluation. Evaluating both the PRODUCT and the PROCESS is particularly important when the instructor wants to know why the student failed the test.

In deciding how to evaluate correct performance, it is helpful to consider some situations in which (1) usually only the PRODUCT is evaluated (Example E), (2) usually only the PROCESS is evaluated (Example F), and (3) usually both the PROCESS and the PRODUCT are evaluated (Example G).

TASKS IN WHICH USUALLY THE PRODUCT IS THE FOCUS OF THE EVALUATION

1. Aim-fires a rifle
2. Types a business letter
3. Creates a window display
4. Sews in a zipper

Example E
Product Focus

TASKS IN WHICH USUALLY THE PROCESS IS THE FOCUS OF THE EVALUATION

1. Sells auto parts to customer in person
2. Administers an injection to a patient
3. Participates in a job interview
4. Greets passengers boarding an airplane

Example F
Process Focus

TASKS IN WHICH USUALLY BOTH THE PROCESS AND THE PRODUCT ARE EVALUATED

1. Carves meat
2. Cuts and shapes hair with scissors
3. Applies a wood finish to a chair arm

Example G
Process and Product Focus

STEP 3: (Continued)

When trying to determine if the PRODUCT should be the major focus of the evaluation, the following guidelines can provide some helpful clues. If most of the following statements apply to the situation, then it is very likely that the PRODUCT should be the main consideration in the evaluation.

1. There is a definite, tangible product resulting from the performance which can be objectively measured.
2. There are no specific steps to be followed in attaining the product or the proper steps have not been taught.
3. Most or all of the evidence required to evaluate the performance can be found in the tangible product that results from the performance of a competency.
4. There are not enough individuals available to evaluate the PROCESS the student must follow to obtain the desired product.

If you decide that the performance can be evaluated by assessing the PRODUCT, then identify the characteristics that make the PRODUCT acceptable. In the example below, the acceptable characteristics of the PRODUCT have been identified.

PERFORMANCE: Fastening Edges of Wood with Nails

PRODUCT CHARACTERISTICS:

1. Strength
 - a. splitting
 - b. spacing utility
2. Product Appearance
 - a. straightness
 - b. hammer marks
 - c. depth

Example H
Identify PRODUCT Characteristics

STEP 3: (Continued)

Sometimes, the PROCESS used to obtain the desired outcome is the major focus of the evaluation. The following guidelines should be helpful in identifying those competency statements for which the evaluation of the PROCESS is of primary importance. If most of the following statements apply to the situation, then it is very likely that the PROCESS should be the major focus of the evaluation.

1. There are specific steps or procedures which have been clearly identified and are explicitly taught to students.
2. Any changes from the accepted procedure can be accurately identified and objectively measured.
3. Most, or all, of the evidence required to evaluate the performance can be identified only while the performance is taking place, and little evidence of the correct performance is available as a tangible product after the performance has been completed.
4. Enough competent individuals are available to evaluate the PROCESS the student uses as it takes place.

If you decide that performance can be evaluated by assessing the PROCESS the student uses to obtain the required outcome, then list each of the operations and/or steps the student must perform. In Example I below, the procedure a student must follow to obtain the desired outcome is shown.

	STEPS TO BE FOLLOWED
PERFORMANCE:	Starts engine of truck
PROCEDURE:	1. Depresses clutch pedal
	2. Checks gearshift lever for neutral position
	3. Turns on ignition switch before pressing starter button
	4. Releases starter button as soon as engine starts to operate on its own
	5. Uses choke properly in getting engine to run

Example I
List Process Steps Or Operations

STEP 3: (Continued)

Often it is useful to evaluate both the PRODUCT which results from the performance of a competency and the PROCESS followed to obtain the desired product or outcome. This is particularly useful when evaluating the results of training. While it may be sufficient to evaluate only the PRODUCT, if the PRODUCT is not satisfactory, a PROCESS evaluation can help the instructor determine what went wrong. This information is useful in identifying student weaknesses and possible deficiencies in the training program.

The instructor must analyze the performance required to decide if both the PRODUCT and the PROCESS should be evaluated. The guidelines just discussed on pages 8 and 9 should be helpful in making this decision. Example J below identifies a performance in which both the PRODUCT and the PROCESS are evaluated. Only a sample of the characteristics and procedures are included.

PERFORMANCE:	Fabrication of a Rigid Tubing Assembly
PROCEDURE FOLLOWED:	1. Removes damaged tubing 2. Inspects replacement tubing to see that it is free from surface defects 3. Inspects replacement tubing to see that it is of the required thickness 4. Marks tubing at end of recess or back board fitting to get first level
PRODUCT CHARACTERISTICS:	1. Entire service of tube and fittings <u>completely</u> free from scratches 2. Back board flare <u>completely</u> free of burrs inside and out 3. Back board flare at least 80% of original thickness

Example J
Assessing PROCESS and PRODUCT

STEP 3: (Continued)

In some situations, speed must be considered when evaluating a PRODUCT and/or a PROCESS. If speed is important, the length of time required to produce the desired product or to perform the necessary procedure must be identified. The instructor must make this decision with the assistance of the program advisory committee. In Example K below, the time required by the student affects the points that he/she earns.

Time and Points Earned

PERFORMANCE: Wiring and Timing an "In-Line" Gasoline Engine

Time Started _____ Time Completed _____

Check (✓) the appropriate box in the third column based on the time required by the student to wire and time the engine.

Minutes	Possible Points	Earned Points
12 and under	5	☐
13-15	4	☐
16-18	3	☐
19-21	2	☐
22-24	1	☐
25 and over	0	☐

Total Points Earned _____

Example K
Identify Length Of Time Required

STEP 4: MAKE A LIST OF THE NECESSARY TOOLS, EQUIPMENT, AND
SAFETY PRECAUTIONS.

Make a list of all the necessary tools and equipment that need to be available. If possible, tell the student where he/she can obtain what is needed. When safety precautions are important, include a statement of them in this section of the performance test. Example L below shows how the tools and equipment needed are identified for the student.

PERFORMANCE: Fabrication of a Rigid Tubing Assembly

Tools: The following tools are needed:

1. Tubing cutter
2. Hand tube bender
3. File
4. Mallet
5. Parker flaring tool
6. Pencil
7. Burring tool or pen knife

Equipment: The following equipment is needed:

1. Three (3) pieces of 52 90 tubing
2. 18" long, .040 wall thickness

Example L
List The Tools and Equipment

STEP 5: WRITE THE DIRECTIONS TO THE STUDENT

When writing directions to the student, keep the vocabulary simple so that students can understand exactly what they are to do. These directions should include:

- a. the purpose of the test
- b. the performance expected of the student
- c. how the student will be evaluated
- d. the tools, equipment, or other materials which will be provided
- e. any safety precautions which should be observed

Example M illustrates directions that can be given in written form to the student (or read aloud).

PERFORMANCE: Fabrication of a Rigid Tubing Assembly									
<u>Instructions to the Student</u>									
<u>Task:</u>	This is a test of your ability to fabricate a rigid tubing assembly. Look at the "mock up" of a typical rigid tubing assembly which is in front of you. The tubing in the "mock up" is damaged and <u>your task is to replace that tubing</u> . Do the replacement exactly as you would ordinarily do it. This is, imagine that the damaged tubing is in a plane. In order to facilitate the scoring, first form the back piece bend (vertical leg) with fitting, (repeat) first form the vertical bend with fitting and then the horizontal bend and fitting. You may assume that the pressure in the system is zero.								
<u>Scoring:</u>	You will be marked in the following areas: 1. The QUALITY of the finished product. 2. The PROCEDURE you followed in doing the job. 3. The MANNER in which you use your tools. 4. The SAFETY precautions you observe. 5. The TIME it takes you to complete the job								
However, the principal scoring emphasis is on doing the job well, so do not sacrifice doing a good job for speed.									
<u>Tools:</u>	<table border="0"><tr><td>1. Tubing cutter</td><td>5. Parker flaring tool</td></tr><tr><td>2. Hand tube bender</td><td>6. Pencil</td></tr><tr><td>3. File</td><td>7. Burring tools or pen knife</td></tr><tr><td>4. Mallet</td><td></td></tr></table>	1. Tubing cutter	5. Parker flaring tool	2. Hand tube bender	6. Pencil	3. File	7. Burring tools or pen knife	4. Mallet	
1. Tubing cutter	5. Parker flaring tool								
2. Hand tube bender	6. Pencil								
3. File	7. Burring tools or pen knife								
4. Mallet									
<u>Equipment:</u>	Three (3) pieces 52 30 tubing, 18" long, .040 wall thickness.								

Example M
Directions To The Student

STEP 6: WRITE THE DIRECTIONS TO THE TEST ADMINISTRATOR

The directions to the test administrator are written to ensure that different instructors are able to administer the same test to students with minimum changes in conditions (lighting, equipment, safety precautions, visibility, temperature, attitude of tester, time of day, etc.) present in the testing environment.

The test administrator's directions should include (a) specific steps to follow when administering the test, (b) written directions which will be read to the student, and (c) specific directions for evaluating and scoring student performance including necessary rating scales or checklists.

PERFORMANCE: fabrication of a Rigid Tubing Assembly

Test Administrator's Instructions

TASK: This is a test of the examinee's ability to fabricate a rigid tubing assembly.

GENERAL DIRECTIONS TO THE TEST ADMINISTRATOR:

1. Read very carefully and thoroughly the "Instructions to the Student".
2. Assign the student to work station and provide him/her with the "mock up", tools, and materials.
3. Have the student read the "Directions to the Student". Make sure that the student understands what to do before starting the test.
4. Point out necessary safety precautions.
5. Have the student put the work station back in order when he/she is finished.

SCORING:

Carefully observe the student as he/she works and indicate his/her performance on the checklist provided. Circle the appropriate number based on whether the student did or did not satisfactorily perform the identified procedure. Add up the 1's that are circled and enter the total in the space provided at the bottom of the form. Give complete attention to the scoring. Do not rely on your memory. The measurement of the final product will be made after the student has completed the job.

TIME:

Time is counted as soon as the student being tested understands what he/she is to do and is told to start. Record the time that he/she starts and finishes in the appropriate spaces. For credit on the time item, the student must finish in 23 minutes or less. If the student does not finish in 23 minutes or less, allow him/her to finish; however, no credit will be given.

Example N Directions To The Test Administrator

STEP 7: PREPARE A CHECKLIST OR RATING SCALE WHICH CAN BE USED TO EVALUATE THE PROCESS FOLLOWED AND/OR THE PRODUCT PRODUCED BY THE STUDENT.

Checklists and Rating Scales can be used to evaluate a PRODUCT, a PROCESS, or both PRODUCT and PROCESS. Some general information on how to construct checklists and rating scales is given below. More specific information is provided on the next three pages.

GENERAL RULES FOR CONSTRUCTING CHECKLISTS AND RATING SCALES

When developing either rating scales or check lists to use in evaluating student performance, there are some basic rules which should be followed:

1. Make the checklist or rating scale as easy-to-complete as possible. Do not crowd too much print on a single page.
2. Clearly label the checklist or rating scale as to the competency statement on which the student is being evaluated.
3. Include blanks for name of student, name of instructor, name of evaluator, the date, and course name and number.
4. Number the items and pages so the evaluator (test administrator) will not become confused while completing the instrument.
5. Be sure that each item refers to only one procedure or one characteristic unless it is always necessary to perform two procedures together or evaluate two product characteristics jointly.
6. Place the response areas on the left or right side of the page for ease in scoring.
7. Do not use abbreviations unless they are common terminology of the trade.
8. If items appear on both sides of the page, put the word OVER or CONTINUED ON THE NEXT PAGE at the bottom of the first page.

STEP 7: (Continued)

HOW TO CONSTRUCT A RATING SCALE:

While rating scales may be used to evaluate a PRODUCT or a PROCESS, they are used most often for PRODUCT evaluation. When a rating scale is used, the PRODUCT or PROCESS is evaluated along a scale which represents varying degrees of quality or correct performance. The following steps are suggested for developing a rating scale:

1. Identify the characteristics of the PRODUCT or steps in the PROCESS. (This should be done in Step 2 of the Basic Steps in Constructing a Performance Test, page 7.
2. Establish a scale which represents the degree of quality or completeness of each characteristic or procedure identified in the preceding step. This scale may vary from two positions to as many as ten, and each position should be represented by a number and/or a brief description of the degree of quality or performance.
3. Provide clear, concise directions for completing the Rating Scale. Indicate whether the appropriate response should be checked, filled in, circled, etc.
4. Develop scoring procedures to be included in the test administrator's directions.

PERFORMANCE:		Fastening Edges of Wood With Nails	
Student's Name			Date
Evaluator's Name			Course
DIRECTIONS:			
Circle the number which reflects the quality of the item being rated. "1" indicates unsatisfactory quality; "2" indicates average quality; "3" indicates above average quality. Add up the circled numbers and enter the total in the space at the bottom of the form.			
PRODUCT STRENGTH:			
1. Splitting:	Is wood free of splits radiating from nail holes?	1	2
2. Spacing:	Are nails spaced too close or too far apart?	1	2
3. Utility:	Will the nails hold?	1	2
PRODUCT APPEARANCE:			
4. Straightness:	Are nails driven straight, heads square with wood, no evidence of bending?	1	2
5. Hammer Marks:	Is wood free of hammer marks around nail?	1	2
6. Depth:	Are depths of nails uniform and of pleasing appearance?	1	2
Possible Points =		18	
Total Points Earned =			

Example O
Rating Scale

STEP 7: (Continued)

Checklists may be used to evaluate a PRODUCT, a PROCESS, or both; however, they are particularly useful for recording performance of a PROCESS. The following steps are suggested for developing checklists.

1. Identify the specific operations and/or steps which the student should perform. (This should be done in Step 2 of the Basic Steps in Constructing a Performance Test, page 7.)
2. Arrange the steps in the order they should occur or in some other logical order.
3. Determine the response for each step. You may prefer to use columns labeled YES and NO and check the appropriate response based on whether the step was or was not performed. Another method would be to simply place a check mark after the step indicating that the action has occurred. The instructor should select the response method most appropriate for the performance being evaluated.
4. Provide clear, concise directions for completing the checklist. Indicate whether the appropriate response should be checked, filled in, circled, etc.
5. Develop scoring procedures to be included in the test administrator's instructions.

STEP 7: (Continued)

PERFORMANCE: Participates In A Job Interview		
Student's Name _____	Date _____	
Evaluator's Name _____	Course _____	
DIRECTIONS TO EVALUATION: The items identified below are to be used as guidelines in determining the score the student receives on the <u>actual interview</u> part of a job interview. Each correct behavior is worth two points. The correct response for each item is indicated in the Yes/No column by a *. The maximum number of points is 38. Place a check (✓) in the appropriate column for each item and then add up the correct responses for a total score.		
ACTUAL INTERVIEW - PROCESS	Yes	No
1. Promptly greeted interviewer and called by name?	*	
2. Introduced himself/herself correctly?	*	
3. Shook hands only after interviewer offered to do so?	*	
4. Remained standing until invited to sit down?	*	
5. After seated, sat in a comfortable and erect position?	*	
6. Was polite and courteous, but did not overdo it?	*	
7. Chewed gum or smoked?		*
8. Gave brief, accurate information to questions asked?	*	
9. Answers to questions were well thought out?	*	
10. Monopolized the interview?		*
11. Volunteered appropriate information?	*	
12. Asked pertinent questions?	*	
13. Got a clear answer in regard to wages?	*	
14. Was calm throughout interview?	*	
15. Used correct English?	*	
16. Displayed self-confidence?	*	
17. Was a good listener?	*	
18. Acted interested, alert and enthusiastic?	*	
19. Thanked the interviewer for time and consideration?	*	
TOTAL SCORE = _____		

Example P
Check List

RULES FOR CONSTRUCTING CHECKLISTS AND RATING SCALES

A Checklist

Well written performance tests should:

- ____ 1. Be easy to complete.
- ____ 2. Not have too much print crowded on a page.
- ____ 3. Be clearly labeled as to what competency is being evaluated.
- ____ 4. Include blanks for (1) name of student, (2) name of instructor, (3) name of evaluator, (4) the date of the test, and (5) course name.
- ____ 5. Have items and pages numbered clearly.
- ____ 6. Have items which refer to only one procedure or one characteristic unless two procedures or two characteristics always go together.
- ____ 7. Have rating scales or checklists with response options on the left or right side.
- ____ 8. Not use abbreviations unless they are common terminology of the trade.
- ____ 9. Include OVER or CONTINUED ON THE NEXT PAGE if the test is printed on both sides of page.

STEP 8: TRY OUT THE PERFORMANCE TEST WITH A FEW STUDENTS

After you have developed your performance test, try it out with a few students or workers and identify any problems you have. Make changes that are needed until a performance test is constructed which allows (a) the same instructor to judge different students fairly and in the same way and (b) different instructors to simultaneously judge the same student competent or incompetent by using the same checklist or rating scale.

DEFINITIONS

Competency or Competency Statement: A cluster or grouping of several tasks which is frequently the terminal performance expected of the student. A competency statement tells the employer what the student can do.

Competency Record: A form which is used to record the student's performance on each of the competencies identified for a specific occupation.

Performance Test: A test in which the necessary conditions for performing a competency (or group of tasks) are designed to match as closely as possible the actual conditions under which the task is performed on-the-job.

Process: The procedure used to obtain the desired product or outcome.

Product: The tangible outcome that results from the performance of a task or competency.

Task: A complete element of work performed by a worker or student.

Task Listing: A complete listing of all the tasks (organized under competency statements) which a worker in a specific occupation must be able to perform.

Terminal Performance Objective: A statement of the terminal performance expected of the student which includes (1) the conditions which will surround the performance, (2) the actual performance required, (task or tasks statement), and (3) the minimal level of acceptable performance. The terminal performance objective is developed using a single task or a group of tasks that are normally performed together by a worker on-the-job.

APPENDIX B

COMPETENCY ASSESSMENT:

A Vocational Instructor's Guide to Developing

WRITTEN TESTS



Statewide Curriculum Articulation Project
for Vocational Education
3584 White Bear Avenue
White Bear Lake, Minnesota 55110



8/3/76

CONSTRUCTING WRITTEN TESTS

An objective-referenced, mastery test is an evaluation instrument which assesses the degree to which a student has achieved minimal performance objectives. Three types of objective questions (multiple-choice, matching, and supply-type questions) may be used on the written test. Objective test items can be scored quickly, easily, and accurately. Less pupil time is required for answering individual objective items and this allows the teacher to ask more questions and to more adequately sample content on a test.

STEPS IN PREPARING A TEACHER-MADE TEST

The following steps are essential in preparing an objective teacher-made test. The basic steps are listed below and more detailed explanation appears on the following pages.

Steps in Preparing a Written Test

1. Identify the competency area and competency statement.
2. Refer to your performance objectives for each statement of competency.
3. Prepare a Table of Specifications (explained on a following page) based upon the performance objective(s) that will be tested under each statement of competence.
4. Select the type of test items most appropriate for measuring the performance required of the student.
5. Write the test items.
6. Assemble the individual test items into a test format.
7. Prepare an answer sheet.
8. Set up a scoring system to be shared with students.
9. Set aside a time to examine individual student results and share these results with the student(s).

EXPLANATION OF STEPS IN PREPARING A TEACHER-MADE TEST

Step 1. Identify The Competency Area and The Competency Statements Within That Competency Area To Be Tested

Identification of the area to be tested merely involves giving the name of the competency area (example: Suspension and Steering and the competency statements within that area).

Step 2. Refer to Your Performance Objectives For Each Competency Statement

You have already prepared the performance objective for each statement of competency on the competency record. The performance objectives are the basis for the preparation of your objective-referenced written mastery tests. (You also have the option to use oral tests or performance tests.)

Step 3. Prepare A Table of Specifications Based Upon The Performance Objectives That Will Be Tested Under The Statements of Competency That You Have Selected.

A Table of Specifications is a matrix which shows the number of questions which will appear on a test instrument. The Table of Specifications is useful as a test blueprint and helps to assure that the emphasis given to a particular objective during class instruction is proportionate to the emphasis given to that objective on the test instrument.

Step 4. Select the Type of Test Item Most Appropriate
For Measuring the Performance Required of the
Student.

Certain types of objective test items are more effective than other types in assessing satisfactory achievement of particular performance objectives.

Multiple-choice items are the most versatile kinds of objective items and may be used to assess a student's ability to:

RECALL

PROBLEM SOLVE

Matching items may be used to assess a student's ability to:

DISCRIMINATE

Supply-type items may be used to assess a student's ability to:

COMMUNICATE

The appendix contains a listing of words commonly used in performance objectives, to designate whether the student is required to RECALL, COMMUNICATE, DISCRIMINATE or PROBLEM SOLVE.

Step 5. Write the Test Items

There are three major types of objective test questions:

1. multiple-choice
2. matching
3. supply-type

Each of these three major types of objective questions is defined and discussed in detail on the following pages. At the end of the discussion of each particular test item type, a check-list is provided for use in actual test construction.¹

¹ True and false type questions and other questions which only provide two alternatives are generally considered poor types of objective questions because they provide the student too much of an opportunity to "guess" the right answer.

Objective Question Type Goals and Performance Objectives	Multiple-Choice	Matching	Supply-Test	Total Number of Questions for Each Performance Objective
AREA OF COMPETENCE Competency Statement				
Performance Objective	1	2	1	4
Performance Objective		1		1
Performance Objective			3	3
Performance Objective	3		1	4
Total Number of Each Objective Question Type	4	3	5	12

Directions for Preparing a Table of Specifications

The teacher constructs a Table of Specifications by listing, in brief form, goals and performance objectives vertically down the left-hand side of the table. The three major types of objective questions should be written across the top of the Table of Specifications.

Numbers are then placed in the individual cells to indicate the number of test items which will be written to cover each performance objective. Numbers in each horizontal and in each vertical row are then added. The totals appearing along the bottom of the chart indicate the number of matching, multiple-choice, and supply-type items which will appear on the mastery test.

In the sample Table of Specifications presented above, we see that the teacher plans to use one multiple-choice item, two matching items and one supply-type item to test Performance Objective 1 for the first statement of competency. This means that four questions are being used to test a student's knowledge of Performance Objective 1.

In the Appendix, a blank of a Table of Specifications is provided for your use.

MULTIPLE-CHOICE TEST ITEMS

Definition: A multiple-choice question is one which includes (1) a stem (in the form of a question or incomplete statement) which presents a problem and (2) several alternatives (choices which give possible solutions to the problem posed in the stem). The alternatives include the correct answer and several believable wrong answers called distractors.

A Recall Item	
Stem:	
Alternatives:	

A Problem Solving Item	
Stem:	
Alternatives:	

A, B, C and D are alternatives. A, B and C are distractors or wrong choices.

Merits: Multiple-choice items are effective in measuring student's learning. Recall, discrimination, communication, and problem solving ability can be evaluated through the use of properly constructed multiple choice test items. A good multiple-choice item will clearly identify those students who know the information, as well as identify those who do not know the information.

CONSTRUCTING EFFECTIVE MULTIPLE-CHOICE QUESTIONS

I. General Information About Multiple-Choice Questions

- A. Make sure that the question is designed to measure an important learning outcome (performance objective).
- B. Make sure that all information presented in the question is relevant to the main purpose of the item.
- C. Avoid questions which require the student to remember insignificant bits of material which are not relevant to the desired learning outcomes (performance objectives).

II. Wording of the Multiple-Choice Stem

- A. Present a clear, complete problem in the stem of the multiple-choice question.
- B. State the stem in simple, clear language. Make sure that the reading level of the question is appropriate.
- C. Put most of the wording of the question in the stem of the multiple-choice item in order to avoid lengthy choices.
- D. State the stem in a positive form (ask for the best, most, etc. rather than the poorest, least).
- E. When negative wording must be used in the stem of an item, emphasize it by using capital letters and placing it near the end of the stem.
- F. Write the stem in the form of a question (preferred) or an incomplete statement.

III. Wording of Multiple-Choices or Alternatives

- A. Make sure that there is only one clearly correct answer in a multiple-choice item.
- B. Be sure that alternatives (choices) in a multiple-choice item are grammatically parallel in form and are grammatically

compatible with the stem of the item.

- C. Beware of verbal clues which might help the student to choose the correct answer or to eliminate an incorrect choice without really knowing the desired information.
- D. Make the distractors (incorrect choices) seem sensible or realistic.
- E. Try to make the choices about equal in length to avoid as a clue to the correct answer. If this is not possible, beware of making the correct answer longer or shorter than the distractors.
- F. Make all choices as brief as possible.
- G. Give at least three choices for each multiple-choice question. The use of four alternatives is strongly recommended.
- H. Vary the position of the correct answer so that the student does not detect an "answer pattern".
- I. Try to avoid the use of "none of the above" and "all of the above" as alternatives.

IV. General Clues on Constructing a Multiple-Choice Test

- A. List choices in a multiple-choice item on separate lines, under each other.
- B. Use letters in front of alternatives, rather than numbers.
- C. Make certain there is sufficient space between multiple-choice test items.

EFFECTIVE MULTIPLE-CHOICE QUESTIONS

A Checklist

Well-written multiple-choice test questions should:

- _____ 1. Measure an important learning objective.
- _____ 2. Present a clear, complete problem in the stem.
- _____ 3. Have a stem which is written in simple, clear language.
- _____ 4. Contain most of the wording in the stem in order to avoid lengthy alternatives.
- _____ 5. State the stem in a positive form.
- _____ 6. Emphasize any negative words by capitalizing them and placing them near the end of the statement.
- _____ 7. Have a stem which is written in the form of a question or an incomplete statement.
- _____ 8. Have alternatives which are parallel, in form, and which are compatible with the stem.
- _____ 9. Be free of verbal clues which help the student to guess the correct answer.
- _____ 10. Contain realistic or sensible distractors.
- _____ 11. Contain choices which are approximately equal in length and as brief as possible.
- _____ 12. Contain at least three plausible choices or alternatives.
- _____ 13. Have the correct answer in a variety of positions.
- _____ 14. Be independent of each other.
- _____ 15. Have choices which are well-spaced and on separate lines.
- _____ 16. Use letters in front of choices.
- _____ 17. Use standard rules of grammar.
- _____ 18. Have sufficient space between the various test items.

MATCHING TEST ITEMS

Definition: A matching test question is one which includes (1) directions telling a person how to match two sets of items, (2) a list of numbered premises (stems in the form of statements, incomplete sentences, phrases, words, or other symbols) and (3) a list of lettered responses (choices in the form of words, phrases, numbers, or other symbols). The premises may be listed to the left of, above, or below the responses. Technically, a matching question is a modified multiple-choice question in which all the stems have the same choices or alternatives.

Merits: A matching test item is especially effective in evaluating a student's ability to discriminate, associate, or connect related ideas or objects. In addition, matching items occupy less space than the same number of multiple-choice items and can be scored on a completely objective basis.

CONSTRUCTING EFFECTIVE MATCHING QUESTIONS

I. General Information About Matching Questions

- A. Matching questions are designed to measure basic learning outcomes.
- B. Each set of premises and responses in a matching question should refer to the same general topic (that is, each matching set should refer to the same competency).
- C. Write directions which are clear and complete. The directions should indicate (1) whether or not responses may be used more than once, (2) if there is only one correct response for each premise and (3) if there are some responses which will not be used at all.

II. Wording of the Premises

- A. Make sure that premises are clear and complete.
- B. The list of premises should contain the longer phrases or statements, and the responses should be fairly short.

III. Wording of Responses

- A. The list of responses should consist of short phrases, words or symbols.
- B. Write responses which are realistic for each premise.
- C. Avoid helping students to "guess" the correct answer; do not give grammatical clues (mixing singular and plurals in the list of responses, etc.).

- D. Limit the number of responses in a matching exercise to about ten items. If necessary, divide the exercise into two or more separate parts.
- E. Arrange matching responses in a logical sequence in order to save the student reading time in finding the desired answer. Responses may be arranged in alphabetical, chronological, or in some other logical arrangement.

IV. General Clues on Constructing a Matching Test

- A. Usually, premises are listed on the left-hand side of a page and responses are listed on the right-hand side of a page. However, the premises may be placed above or below the responses.
- B. Use numbers to identify individual premises and letters to identify individual responses.
- C. Try to make the list of responses either longer or shorter than the list of premises.
- D. Arrange matching items so that students can easily read the premises and responses.

EFFECTIVE MATCHING QUESTIONS

A Checklist

Well-written matching test questions should:

- _____ 1. Measure a basic learning outcome, as described in the performance objective.
- _____ 2. Contain premises and responses which are homogeneous or refer to the same general topic.
- _____ 3. Include directions which are clear and complete.
- _____ 4. Contain premises which are clear and complete.
- _____ 5. Have premises which contain the longer phrases or statements and responses which are fairly short.
- _____ 6. Include responses which are realistic for each premise.
- _____ 7. Be free of grammatical clues which could help a student "guess" an answer.
- _____ 8. Be limited to about ten responses per question.
- _____ 9. Have responses which are arranged in a logical order.
- _____ 10. Contain numbers which identify individual premises.
- _____ 11. Contain letters which identify individual responses.
- _____ 12. Contain a list of responses which is not the same length as the list of premises.
- _____ 13. Be physically arranged so that students can easily read the premises and responses in the questions.

SUPPLY-TYPE TEST ITEMS

Definition: A supply-type test item is one which requires a student to provide one or two missing words or symbols. Instead of selecting the correct answer from several choices, the student must write the answer which correctly complete a statement or answers a question.

Supply-type items are of two basic forms:
(1) completion or fill-in (the student must complete or finish a statement) and (2) short-answer question (the student must answer a question using a word or a short phrase).

Merits: A supply-type question is useful when a student is expected to be able to name, provide a list or know definitions and technical terms. Supply-type items actually test whether or not a student can communicate certain information. Completion and short answer questions are easy to construct and they provide little opportunity for a student to guess.

CONSTRUCTING EFFECTIVE SUPPLY-TYPE QUESTIONS

I. General Information About Supply-Type Questions

- A. Supply-type questions are generally used in determining whether or not a student can recall and communication information.
- B. Supply-type questions ask the student to give only important words or symbols.

II. Wording of the Supply-Type Question

- A. Word each item so that there is only one short, definite answer possible.
- B. Avoid asking the student to supply a verb, pronoun, or adverb in a completion or short answer question.
- C. Word the completion statement so that the blank is near the end of the sentence.
- D. When possible, use the question form rather than the incomplete statement form.
- E. Avoid using statements which are taken verbatim from a textbook.
- F. Avoid asking the student to supply more than one or two words in a single fill-in question. Require the student to supply only a short phrase in a short-answer question.
- G. In computation problems, be sure the student knows the degree of precision and the units which he is to use to express his answer.

- H. Avoid giving hints within the question which will assist the student in answering the question.

III. General Clues on Constructing a Supply-Type Test

- A. Keep answer blanks uniform in length; the varying of line lengths can often be a clue to the correct answer.
- B. Provide enough space for the student to answer the question.

EFFECTIVE SUPPLY-TYPE QUESTIONS

A Checklist

Well-written supply-type questions should:

- _____ 1. Measure whether or not a student can recall and communicate information directly or recall information needed to find a solution or answer to a problem.
- _____ 2. Require a student to supply only important information (words or symbols).
- _____ 3. Have only one possible answer which is short and definite.
- _____ 4. Have the blank near the end of the sentence.
- _____ 5. Be in the form of a question, when possible.
- _____ 6. Be worded so that they are not directly quoted from a textbook.
- _____ 7. Require the student to supply only one or two words.
- _____ 8. Contain information indicating the degree of precision and units in which the student should answer.
- _____ 9. Be free of hints which aid the student in answering the question.
- _____ 10. Contain answer blanks which are uniform in length.
- _____ 11. Provide sufficient space for the correct answer.

APPENDIX

TABLE OF SPECIFICATIONS

Objective Question Type Goals and Performance Objectives AREA OF COMPETENCE				
	Multiple-Choice	Matching	Supply-Type	Total Number of Questions for Each Performance Objective
Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____				
Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____				
Competency Statment _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____				

(21)

Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____			
Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____			
Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____			
Competency Statement _____ P.O. 1 _____ P.O. 2 _____ P.O. 3 _____ P.O. 4 _____ P.O. 5 _____			

Recall - The ability to know what to do, what to use, and the order in which to perform various activities.

match	recall	sequence
-------	--------	----------

Discrimination - The ability to distinguish one thing from another; to tell when an operation needs to be done. It is also the ability to see the difference between that which is correct and that which is not. Discrimination may be determined by sight, sound, smell, feel, and taste of remembrance of a correct situation.

associate	decide	divide	judge
check	detect	evaluate	pick
choose	determine	identify	recognize
compare	differentiate	inspect	select
contrast	discern	interpret	test
couple	distinguish	isolate	

Communication - The ability to express your knowledge to others. When a student is required to communicate what he/she knows to others, he/she must often do this quickly and accurately as possible.

cite	label	recite	re-state
copy	letter	record	say
demonstrate	list	reiterate	transcribe
describe	name	repeat	type
give a word for	participate	reply	write
indicate	pronounce	reproduce	
inumerate	quote	respond	

Manipulation - The ability to know how to do what needs to be done. The student must know how to perform each manipulative skill required to complete an operation.

activate	flush	order (arrange)	signal
adjust	grasp	perform	slide
align	hold	pickup	solder
arc	insert	place	start
assemble	install	prepare	stencil
bleed	left	press	straighten
change	load	pressure test	tighten
charge	locate	pull	torque
clean	loosen	push	touch
close	lubricate	remove	trace
construct	machine	repack	tune
demonstrate	maintain	repair	turn
demount	measure	replace	turn off-on
disassemble	meet	reset	twist
discharge	mount	reverse flush	typewrite
drain	move	rotate	undercut
evacuate	open	service	vacuum
file	operate	set	

Problem Solving - The ability to find a solution or answer to a problem. The student needs to be taught the procedure which will help him/her determine the nature of the problem and what should be done to correct the situation in the most efficient and effective manner.

decide	figure out	solve	work through
diagnose	find	troubleshoot	
estimate	rebuild		

GENERAL GUIDELINES FOR CONSTRUCTING OBJECTIVE TESTS
(multiple-choice, matching, or supply)

General

1. Have a clear purpose for testing and share this purpose with the students.
2. State all questions at the appropriate level of difficulty for the students being tested.

Length

1. Write enough test items to adequately sample student achievements.
2. Consider the amount of time available and the amount of time which the student will need to answer each question when determining the length of a test.
3. Consider pupil fatigue level when determining the length of a test.

Item Arrangement

Group the test items in one or more of the following ways:

Item types (grouping all multiple-choice, all matching, and all supply-type items together).

Subject matter (group questions about the same subject together).

Easy to difficult (arrange items from the easiest to the hardest).

Physical Clarity

1. Avoid crowding test items on a page.
2. Provide the students with clearly-printed tests.
3. Number all items in consecutive order.
4. Proofread for errors.
5. Identify the test by stating the subject, grade-level, unit, or topic tested, date and the form of the test on the student's test copy.

Wording

1. Word each test item so that it is independent of all other items on the test.
2. Avoid ambiguous test questions.
3. Avoid using verbatim statements from a book.
4. Include any qualifications which might be relevant to the test question.
5. Avoid giving clues within a question or in another question which might assist a student.
6. Consider the reading level of a question (use synonyms for difficult words).

Directions

1. Give complete instructions for the entire test and for separate sections of the test.
2. Inform the student of the amount of time he/she will have to answer the test questions.
3. Explain, in full, how the student is to record his/her answers.
4. Provide practice items for the student, when necessary.
5. Inform the student of the scoring procedure for each questions.
Explain that this test will be scored on the basis of the number of correct answers.

RE-EXAMINATION OF THE WRITTEN TEST

Once you have constructed a standardized¹ test for your region, it should be administered to students and then re-examined and modified. This section describes how to re-examine the test.

Some items may need to be replaced. It's best to keep building year after year upon the instrument you have. The goal is to develop a valid, reliable tool for assessing student competency. The test should be administered to students in a controlled situation and students should never be allowed to keep copies of the test after it has been administered. It may be desirable to have parallel forms of the same test.

One difference between the criterion referenced test which is used in competency based programs and a norm-referenced test is in the expectation of the teacher regarding the student's abilities to answer the test questions correctly. In criterion referenced testing, you want every student to show competency by choosing the correct answer and some items therefore purposely appear on the criterion referenced test, even though in almost all instances students answer them correctly. These are generally items that test the students' knowledge of facts needed by every worker-on-the-job. Assuming that you will be identifying those items that are of this kind, the following actions can be taken by you to determine which of the other items on the test are discriminating the students who are competent from those who are not. (For instance, in auto mechanics, some test items are purposely constructed to discriminate between students who can and cannot diagnose the cause of a set

¹"Standardized" means that specific instructions for administration and scoring are written down.

of described symptoms. Students who have practiced and are competent, answer them correctly. Those that are not competent do not answer the item correctly.) The procedures described in this section will help you identify which items do and which items do not separate your competent students from your incompetent students. Items that you want to be able to use to separate competent students from those students who need more practice, will need to be re-examined and replaced. Once you have good test items, they can be used successfully again and again.

Item Analysis

Look upon each test item to discover its strengths and weaknesses. You will need to consider both (a) the level of difficulty of each item and (b) each item's discriminating power.

Level of Difficulty

The level of difficulty is simply the percentage of pupils who answer the test item correctly.

$$P = \frac{NR}{NT} (100)$$

where P= percentage of pupils who answer the test item correctly

NR= number of pupils who answered the test item correctly

NT= total number of pupils who attempted to answer the test item.

If you make a chart of pupil responses to each of the test items, then the level of difficulty can be computed quickly.

In using this formula to compute the level of difficulty of an item, consider two things:

- (1) Is the number of pupils who have attempted to answer

the item the same as the number of pupils who were administered the test, or did time prohibit some students from reaching that item? (It's best to allow all students time to finish.)

- (2) Is the number of pupils who answered the item correctly realistic in the sense that they knew the answer or did the item provide opportunity for guessing the right answer? (Look at the item stem and distractors closely as is advocated in the first sections of this booklet.)

Because it is unlikely that test items will be highly inter-correlated because they are developed to relate to different tasks, it is recommended that the test items be those with a level of difficulty between 40 and 70 percent.

Item Discriminating Power

The discriminating power of an item is the ability of that item to differentiate between those pupils who have done well (the upper group) and those who have done poorly (the lower group).

Here, you can use another criterion to first classify the students into upper, middle and lower groups. Such a criterion might be performance scores on shop work, especially if judgements of student ability have been made by a different instructor. Another approach is to use the internal consistency method described below.

Rank order the total test scores for the class and divide the score into three groups of scores: the upper group, the middle group and the lower group. In computing item discriminating power the rationale is this: A test item that has maximum discrimin-

ating power is one which every pupil in the upper group answers correctly and one which every pupil in the lower group answers incorrectly. The following formula can be used to compute an index of discriminating power of an item.

$$D = \frac{U - L}{N}$$

where D = index of item discriminating power

U = number of pupils in the upper group who answered the test item correctly

L = number of students in the lower group who answered the test item correctly

N = number of pupils in each of the two groups

The maximum size of the index is +1.00; the minimum size is -1.00. Any negative value means that the test item discriminates in the wrong direction. Positive values show that the item discriminates in the desired direction. Values of less than +2.20 are not acceptable. A good test should have items with an index of +0.30 for each item.

When items do not reach the desired (a) level of difficulty and (b) index of discriminating power they will need to be replaced with new items that relate to the same content. Once the test has been administered to students and the items that need replacing have been identified, you may need to look at all of the responses for the items you plan to replace. This can be done quickly and accurately by using a test-scoring machine or computer, providing that the proper answer sheets have been used.

The most important step in developing a good written test is the initial development of test questions. There is no substitute

for well written, well thought out item stems and distractors. Be sure to take plenty of time and do a thorough job and then fewer items will need to be replaced upon re-examination of the test you have constructed. Use the checklist(s) contained in the first sections of this booklet as you construct and replace items.

APPENDIX C

SUBJECT - MATTER CONSULTANTS

The subject matter consultants for task list development were:

<u>Name</u>	<u>Position</u>	<u>School</u>
Argene Whalen	Home Economics Instructor	North High School North St. Paul
David J. Smith	Department Chairperson Construction Trades	Suburban Hennepin Area Vocational Technical Institutue, North Campus

CONSULTANTS - ON - SITE

Articulation project consultants-on-site for each region of Minnesota receiving a grant award during 1976-77 are identified below:

<u>Name</u>	<u>Position</u>	<u>School</u>
Coler Peterson	Automotive Instructor	Rochester AVTI
Gary Zaudtke	Automotive Instructor	Duluth AVTI
Marson Rinkenberger	Automotive Instructor	Crookston H. S.
Roger Anderson	Automotive Instructor	Mankato AVTI
Dale Brick	T & I Coordinator	Brainerd AVTI
John Mlinar	Automotive Instructor	Hutchinson AVTI
Jim Schnell	Automotive Instructor	Willmar AVTI
Dick Maki	Automotive Instructor	Hibbing AVTI
Ron Svedjen	Business & Office Chairperson	Bemidji AVTI

APPENDIX E

**AN
ARTICULATION
PROCESS MANUAL**

FOR

ADMINISTRATORS AND CONSULTANTS-ON-SITE

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INTRODUCTION

Articulation is a process which involves post secondary instructors and secondary instructors working together to provide a smooth transition between vocational curriculum at the secondary and post secondary levels. Articulation occurs when there is discussion, consideration of alternatives, and decisions made by those teachers who deliver vocational instruction to students.

Vocational curriculum is vertically articulated when a student can progress from one level of training to the next higher level of training without experiencing unnecessary gap or overlap in the subject matter learned.

The articulation process has three phases. The first phase involves the structuring of curriculum so that teachers from surrounding schools have a common understanding of what is to be taught. By using task lists and competency records that have been developed at the state level, teachers can work together and write terminal performance objectives for their region. This establishes a common understanding of what students are to learn to do, the conditions of learning, and the standards of performance that the articulating schools within a given region consider acceptable. During the first phase of articulation, decisions are made by the group as to the means of competency assessment that the group wishes to use.

The second phase of the articulation process involves teachers developing tests which can be used to assess student competency. Written tests, performance tests or oral tests can be developed by each individual teacher or, more preferably, they can be developed by teachers from the entire region so that they are standardized for all users.

A competency record is then used by instructors to convey to other instructors or to employers a student's ability to perform job-related tasks.

The third phase of the articulation process involves (a) the updating of articulation materials developed at the regional level (terminal performance objectives, performance tests, instructional materials) and (b) the in-servicing of new staff members who are just beginning to teach in the vocational institutions.

The Minnesota State Department of Education encourages regional articulation of occupational curriculum by providing assistance and funding so that teachers from the post secondary and secondary institutions can work together. This first draft of the Articulation Process Manual sets forth the actions that need to be taken and the sequence of actions which may be followed. To date, three pilot sites in auto mechanics occupations have utilized the ARTICULATION PROCESS described. Continued development and validation of the process is underway.

This present draft copy of this booklet will be useful to administrators and articulation project consultants-on-site as they initiate articulation efforts in cooperation with Minnesota's Statewide Curriculum Articulation Project for Vocational Education.

L. Burger, Director
8/20/76

ACTION #1: WRITE A LETTER OF INTEREST

The director of the post secondary vocational institution that wishes to articulate curriculum within a particular geographic region of Minnesota first needs to declare an interest in obtaining funds and assistance from the State Department of Education. This can be done by writing a letter of interest to the Statewide Curriculum Articulation Project Director, 3554 White Bear Avenue, White Bear Lake, Minnesota, 55110. The letter should contain: (1) The date that the applicant school wishes to begin scheduling secondary-post secondary meetings for teachers, (2) the secondary schools and/or other area vocational technical institutions which the applicant area vocational technical institution prefers to include in a regional articulation effort, and (3) a proposal with a budget attached.

Each of the above three contents is described in further detail below.

(1) The starting date for teachers.

Allow five or six weeks between the time that applicant school administrators begin setting the stage for articulation and the time that the instructors actually begin working together. Leave enough time to contact secondary administrators and explain the articulation effort. When substitute teachers are needed, there must be sufficient time to locate qualified people.

<u>Articulation Meetings To Be Held At NAVTI</u>		
<u>Suggested Dates Are Shown Below</u>		
March 25	Dinner Meeting	
April 2	Release time day	8:00 a.m. - 4:00 p.m.
April 6	Evening session	6:45 p.m. - 9:45 p.m.
April 7	Evening session	6:45 p.m. - 9:45 p.m.
April 13	Release time day	8:00 a.m. - 4:00 p.m.
May 4	Evening session	6:45 p.m. - 9:45 p.m.
May 11	Evening session	6:45 p.m. - 9:45 p.m.
May 13	Evening session	6:45 p.m. - 9:45 p.m.
May 17	Evening session	6:45 p.m. - 9:45 p.m.
May 21	Release time day	8:00 a.m. - 4:00 p.m.
Aug/Sept	Release time day	8:00 a.m. - 4:00 p.m.
Jan/Feb	(3) Release days	8:00 a.m. - 4:00 p.m.

Example

(2) The Schools To Be Included.

List the schools that you wish to include in your articulation effort.

Look at the records for the past five years, making note of the schools from which your students (for the same program you are articulating) have come.

In some cases, letters need to be sent or a phone call will need to be made to surrounding schools to find out whether or not there is a program there that could be articulated with the post secondary program. The example below shows this kind of survey.

SURVEY OF AREA HIGH SCHOOLS OFFERING CLASSES IN AUTO MECHANICS

<u>NAME OF SCHOOL</u>	<u>YES</u>	<u>NO</u>	<u>NAME OF INSTRUCTOR</u>	<u>PRINCIPAL</u>
1. Claremont		X		
2. Dodge Center	X		Glen Papenfuss	Michael Lang
3. Kasson-Mantorville	X		Phil Johnson	Sig Wentzel
4. Byron		X		
5. Blooming Prairie	X		Floyd Davidson**	Glen Robinson
6. Owatonna	X		John Skolte	
7. West Concord		X		
8. Adams		X		
9. Hayfield	X		Floyd Davidson**	Carl Pierson
10. Goodhue	X		Wayne Nelson	
11. Pine Island	X		Dave Kennedy	Ken DeBoer
12. Zumbrota		X		
13. Mazeppa	X		Bob Beniak	
14. Kenyon	X		Al Schmoor	
15. Waukegan	X		Wayne Smith	Howard Wolf
16. Cannon Falls	X		Richard Wolter	
17. Medford		X		
18. Dover-Eyota		X		
19. St. Charles		X		
20. Lewiston	X		Steve Smith	
21. Elgin		X		
22. Plainview		X		
23. Wabasha-Kellog	X		Paul Irlbeck	
24. Lake City		X		
25. Lanesboro*			----	
26. Preston Vocational Center	X		Bill Lehn	Diane Pair
27. Chatfield*			----	
28. Grand Meadow*			----	
29. LeRoy-Ostrander*			----	
30. Spring Valley*			----	
31. Wykoff*			----	
32. Stewartville	X		Bill Tasaler	Joseph Knapp
33. Peterson*			----	
34. Harmony*			---- (Peterson)	Loren Kropowski
35. Rushford & Peterson	X		Don Laumb (Rush)	Gene Fossum
36. Rochester-John Marshall	X		Vern Westbrook	Dr. Robt. Whaley
37. Rochester-Mayo	X		Ron Felt	Dr. Ralph Wright

* Go to Preston Vocational Center

** Teaches in Hayfield and Blooming Prairie

(Example)

(3) A Proposal With A Draft of a Budget Attached

The example below shows the information that needs to be attached.

Proposal

Title: Regional Auto Mechanics Articulation in Southwestern Minnesota

Applicant School: Rochester AVTI

Schools Involved: (Name them)

Date Submitted: April 17, 1976

Background

The statewide Curriculum Articulation Project for Vocational Education has developed task lists and competency records for the program area of auto mechanics occupations. Three pilot sites are currently using these materials and developing articulated curriculum in their regions of Minnesota. During 1976-77 the State Department of Education-Vocational Division is making available assistance and financial support to vocational technical programs in auto mechanics throughout the state. Such assistance and support is available on a grant award basis to applicant AVTI's upon submission of an approved proposal for articulation.

Objective

To demonstrate the articulation of secondary and post secondary auto mechanics curriculum in the Southwestern region of Minnesota.

Personnel

The following persons will be directly involved in the decision making process for articulation in this region of Minnesota:

Dr. Laura Burger , Director
Statewide Curriculum Articulation Project

_____, Director
_____ Area Vocational Technical Institute

_____, Project Consultant-on-site
_____ Area Vocational Technical Institute (to be selected
by Project Director)

_____, Lead Instructor at applicant school, if
different than Project Consultant-on-site

_____, T & I Coordinator or person designated
by the AVTI Director

Mr. Tom Ryerson , State Supervisor
Secondary

Mr. Gordon Williams , State Supervisor
Post Secondary

Names of instructors that will be invited to participate in the regional auto mechanics articulation effort:

Instructor	School	Administrator
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Example)

BUDGET

Developmental (dates)

Dinner meeting (# of people x \$5.00)	_____
Substitute teachers *	_____
5 days x # teachers x rate of pay per sub (\$30)	_____
Teacher contract hours	_____
\$10.00 per hour x 80 hours	800.00
Mileage to meetings (15¢ per mile)	_____
Expenses (receipts required)	_____

Administrative **

Lead instructor if different from Consultant-on-site	_____
30 hours x \$10.00 per hour	300.00
Purchase of materials (task lists & comp. records)	_____
1 set per instructor x \$3.60 per set	_____
Work Sheets and Guidebooks for articulation session use (orange booklets)	_____

Evaluation and Modification

Substitute teachers*	_____
3 days x # teachers x rate of pay per sub. (\$30)	_____
Mileage to meetings (15¢ per mile)	_____
Expenses (receipts required)	_____

Printing

Clerical-secretarial (\$3.00 per hour x 200 hours)	600.00
Documents (Terminal Performance Objective notebooks, tests)	400.00
Competency records	200.00

TOTAL

Local contribution

Facilities for meetings	_____
Xeroxing of working drafts, when needed	_____
Loan of equipment (overhead projector, opaque projector)	_____
Administrative time for releasing teachers and scheduling people, rooms, meeting dates, etc.	_____
Postage and telephone (secondary school contact)	_____
Lead instructor visitations to local schools	_____
Continued time for modification (in-service days) in future years	_____

* remember to include substitute pay and expenses for project consultant-on-site if he/she is from a school outside your region.
Note that substitutes include those needed both at the secondary and post secondary level.

** the Project Consultant-on-site will be paid (salary) out of Statewide Curriculum Articulation Project Funds (\$520). Mileage and expenses will need to be budgeted above.

Note: If teachers wish to work evenings or weekends they will be paid at the same rate as substitute teachers who would otherwise replace them in the classrooms. (\$30 per day).

(Example)

SUMMARY

The first action is, then to write a letter of interest and include (1) the starting date for teachers, (2) the names of schools you propose to be involved and (3) a proposal with a draft of a budget attached.

After receiving the letter of interest, the Statewide Curriculum Articulation Project Director will work with the applicant school Director to refine the budget. Once the grant award is applied for, the actions described in the following sections can be taken.

AVTI DIRECTOR

ACTION #2: PLAN A DINNER MEETING

The director of the post secondary vocational institution should plan a dinner meeting to be attended by principals and instructors. The purpose of this meeting is to give information to people who are being asked to join the regional effort. At the conclusion of the dinner meeting, the instructors who plan to attend the articulation sessions should sign up.

In addition to the invitation mailed to each principal and instructor, a follow up phone call should be made to each person who is invited. This will also help to establish the number of reservations needed for the dinner.

An example of a dinner meeting program is shown below.

PROGRAM T & I Coordinator, Host Introduction of Participating High Schools Introduction of NAVTI Auto Mechanics Staff Welcome.....Dr. Charles Harwood, Director Vocational-Technical Programs in Minnesota A Look Into The Future Gordon Williams and Tom Eyerson, State Department, Vocational Division Curriculum Articulation Dr. Laura Burger, State Department of Education, Vocational Division The Teacher's Role. Coler Peterson NAVTI Staff Adjourn. 8:30 p.m.

(Example)

ACTION #3: WRITE A LETTER TO ADMINISTRATORS

The letter written to administrators should explain the purpose of the articulation effort, and the funds available. It can extend an invitation to them and their auto mechanics instructor(s) to attend the scheduled dinner meeting. The example shown below is the letter written by the Director of Rochester AVTI, to invite principals from surrounding schools to participate in the pilot articulation project.

LETTERHEAD

Date

Inside address for Principal
or appropriate administrator

Dear :

We at the Rochester Area Vocational Technical Institute, along with the State Department of Vocational Education and the local high schools, have long felt that there is a need for a smooth transition and articulation of instruction between secondary programs and post-secondary vocational programs. We know that, too often, students completing high school programs find some of the instruction is duplicated at the post-secondary level. In order to avoid this, the State Department of Education has a secondary/post-secondary articulation project which has been working on the development of materials and processes which will help teachers combine the two levels of education into a meaningful whole.

The best method of resolving the problem of transition between levels of education seems to lie in the process of developing "occupational competencies" so that information already covered at the high school level can be eliminated from the post-secondary program for those students already knowledgeable in a particular area. The development of a program which leads to smooth student transition can only be accomplished if we work together with the area high school administrators and staff in developing articulated curriculum.

Southeast Minnesota will be granted some resources from the State Department of Education to achieve programmatic articulation. The Rochester Area Vocational Technical Institute will act as the fiscal agent for the project, and we would like your district to participate. At this time, available resources indicate that we could budget up to a maximum of \$30 per day for approximately seven days during the 75-76 and 76-77 school years to cover the substitute costs for your auto, indus. arts instructors participating in the program. Additional costs for the development of curriculum materials would be made through agreements with your staff members who develop the materials and such costs would be borne through a grant.

We have not contacted your staff member relative to his/her interest and willingness to participate in the program and will not do so unless you feel that your district would be able to participate in this program. The mandatory costs to your district in the development of an articulated program would be minimal. It is our hope that the benefits derived from such participation would be very substantial to the educational lives of your students.

We will have an information dinner meeting on Thursday, March 23, at 5:30 p.m. at our Institute and hope you and your industrial arts-auto instructor will be able to attend. At this meeting, we will discuss our objectives and a plan to meet those objectives. Please let us know far enough in advance if your district will be interested in participating so that we may contact your auto instructor and invite him to participate.

If you have questions or wish additional information, please contact me at 182-9411.

Sincerely,

Director

Enclosures: A list of all schools receiving invitations to participate
A return post card

P.S. Please return the enclosed card to us by Friday, March 19, to let us know if your district is interested and if you and your instructor will be able to attend the dinner meeting.

(Example)

ACTION #4: MAKE FOLLOW-UP PHONE CALLS

Call each principal so that a record can be made of who will be attending the dinner meeting. Confirm the number of people with food service.

The consultant-on-site or lead instructor will want to schedule an appointment to make a visit to each school and talk with the auto/industrial education instructor. While you have the principal on the phone, ask for permission for the consultant-on-site or lead instructor to contact the instructor directly and set a time for the visit.

[illegible]

(Example)

ACTION #5: VISIT EACH INSTRUCTOR AT HIS/HER SCHOOL

After you get the list of instructors to call from your T&I coordinator, call each auto instructor and set up an appointment to visit him/her in his/her own school.

Make a site visit to each instructor's shop before the dinner meeting. Talk about his present program with him and personally invite him to the dinner meeting. Talk just a little about what the goals of articulation are. Concentrate mostly on understanding his/her situation.

Don't forget to go first to the principal's office and check in before going down to the auto shop area to see the instructor. The principal may wish to walk down to the shop with you.

ACTION #6: HOLD THE DINNER MEETING

Hold the dinner meeting and request that those instructors who will participate in the articulation sessions sign up.

Prepare a tentative list of dates for the articulation meetings. Prepare it as a handout so that each person can have a record of when the meetings will be held. Adjustments due to scheduling difficulties can be made at the first meeting.

A handout that should also be available is the list of names, schools, addresses and phone numbers of all persons invited to participate in the articulation sessions.

ACTION #7: PREPARE A ROLL SHEET

Prepare a roll sheet for the articulation sessions. It will be your responsibility to keep an account of meetings attended by each instructor. This is important because reimbursement to schools for substitutes depends upon whether or not the instructor was in the articulation session that day.

[illegible]

(Example)

THE ARTICULATION PROCESS

The articulation process involves teachers working together to develop curriculum. It is important that group members agree upon decisions that are made so that each instructor is willing to use what the group has developed.

The Project Consultant-on-site has been the leader of the articulation process at least once in another region of Minnesota. He/she will serve as "counsel" to the lead instructor named by the applicant school.

The articulation sessions provide opportunity for instructors in a given region to:

1. Review occupational programs from which industrial representatives throughout the state of Minnesota have indicated that graduates could find jobs.
2. Recognize what is being taught now at the secondary and post secondary levels.
3. Write terminal performance objectives for the program regardless of the level at which the student learned to perform. This includes stating tasks taught to students, the conditions of performance and the standards that are acceptable for the graduate of any auto mechanics program within that region of Minnesota.
4. Decide upon the terminal performance objectives that secondary school instructors wish to use in their auto mechanics programs.
5. Specify the number of hours to be spent in each competency area.
6. Decide upon how to use the Competency Record to communicate what students can do both to other instructors and prospective employers.

7. Decide upon and construct criterion referenced tests to assess student competency.

The section which follows describes the ways that the pilot sites provided the decision making opportunities listed above.

Description

1. Review occupational programs from which industrial representatives throughout the state of Minnesota have indicated that graduates could find jobs.

Task lists and competency record booklets were developed at the State level for three occupational programs in automotive mechanics. They were Lubrication Specialist, Service Center Mechanic, and Automotive Mechanic. The tasks required of the graduate of each of these occupational programs were reviewed by instructors.

2. Recognize what is being taught now at the secondary and post secondary levels.

It proved useful in the pilot projects to read aloud the tasks for automotive mechanics, and, using the Exploratory Workbook (green book), take a tally of the number of instructors that currently teach the tasks listed. Generally a very large number are listed as "taught now". Later in the sessions, however, instructors reduced the number of tasks to teach. Instead of trying to teach so much material, they optioned to teach students the agreed upon tasks so that their students could perform those tasks "so well that" they need not repeat instruction for them at the next level.

3. Write terminal performance objectives for the program, regardless of the level at which the student learns to perform.

The terminal performance objectives state the task(s), the conditions of performance surrounding the task(s) and the standard of performance that is considered acceptable. By filling in the blank spaces of the worksheet as shown below, the terminal performance objectives are easily written.

CURRICULUM ARTICULATION PROJECT	
TERMINAL PERFORMANCE OBJECTIVE	
Automotive Mechanic	
	Area of Competence <u>#6</u>
	Statement of Competence <u>IA</u>
	task(s) <u>1</u>
Given these conditions:	
VEHICLE OR BRAKE SYSTEM UNIT	
You, the student, will be able to:	
CHECK OPERATION OF BRAKE SYSTEM	
So well that:	YOU CAN DETERMINE IF THE BRAKE SYSTEM IS IN NEED OF REPAIR ACCORDING TO PEDAL ACTION AND HEIGHT.
or According to:	
Student performance will be measured by:	
☐ performance test (teacher made)	
☐ performance test (standardized for the region with procedures for administration written down)	
☐ written test	
☐ verbal test (oral)	
The test will be administered by ☐ teacher ☐ student ☐ testing agent	

(Example)

Performance objectives are the same for all students regardless of whether they learn to perform the tasks at the secondary or at the post secondary level.

4. Decide upon the terminal performance objectives that secondary school instructors wish to use in their auto mechanics programs.

Generally this is done by the secondary instructors after some discussion of the areas they feel most capable of teaching and the equipment and space that they have available. If all instructors at the secondary level agree to teach the same tasks and then those that wish to teach more, add on to the basic areas taught by all secondary instructors, then programs at the AVTI level can more easily use group instruction. If all instructors within the region teach students to perform different tasks, then the AVTI will not be able to easily accommodate such a wide variety of student backgrounds. When a student enters with tasks checked on the competency record which are different than those tasks in which his/her classmates are competent, then individualized attention is required to provide him/her with an articulated curriculum. If the AVTI wishes to use group instruction, then the learnings of students entering the AVTI must be as much the same as possible at the secondary level.

5. Specify the number of hours to be spent in each competency area.

A realistic estimate can be made of what will be covered in articulating secondary programs if a chart showing areas covered and number of hours of instruction is made by the group. The example below indicates what one regional pilot site decided to try during its first year of articulation.

Secondary Articulation Decisions Hours to be spent 1976-77				
School	Introduction	Engines	Brakes	Tune-ups
JN	90	90	40	30
M	20	90	40	30
S	90	60	10	30
DC	18	40	0	30
PI	15	90	30	30
H	30	180	50	100 Major
P	all of the tasks in Blue Task List			

The instructors in the schools shown above have decided to confine their teaching to three areas of automotive mechanics (Engines, Brakes and Tune-up) in addition to the introduction. All teachers will use the same competency record and students' grades will be recorded in those three areas. Upon entry to the AVTI those students who have demonstrated competence in performing the designated tasks within these three competency areas will not have to repeat instruction. The AVTI will be expecting some students to be competent in these areas and will have planned opportunities for them to option out of group instruction when those tasks are taught.

6. Decide upon how to use the Competency Records to communicate what students can do, both to other instructors and prospective employers.

The grading scale advocated on the competency record is used with agreement among the teachers regarding what a grade of "4" or "competent" means. The terminal performance objectives were written to establish the standards for the task(s) and assessment of student performance is based upon the terminal performance objective. A grade of "4" competent means that the student will not have to repeat instruction. Students receiving grades of less than 4, will need additional practice in performing the required tasks and/or will need to go through additional learning experiences at the post secondary level.

Auto Mechanics Occupations
Grading Scale for Competency Record

Grading:	5 - able to help others; very competent
	4 - able to perform the task(s) without supervision; competent
	3 - able to perform the task(s) with limited supervision
	2 - able to perform the task(s) with direct supervision
	1 - unable to perform the task(s)
	✓ - received introduction only

7. Decide upon and construct criterion referenced tests to assess student competency. This can include written, oral or performance tests which are based upon the terminal performance objectives.

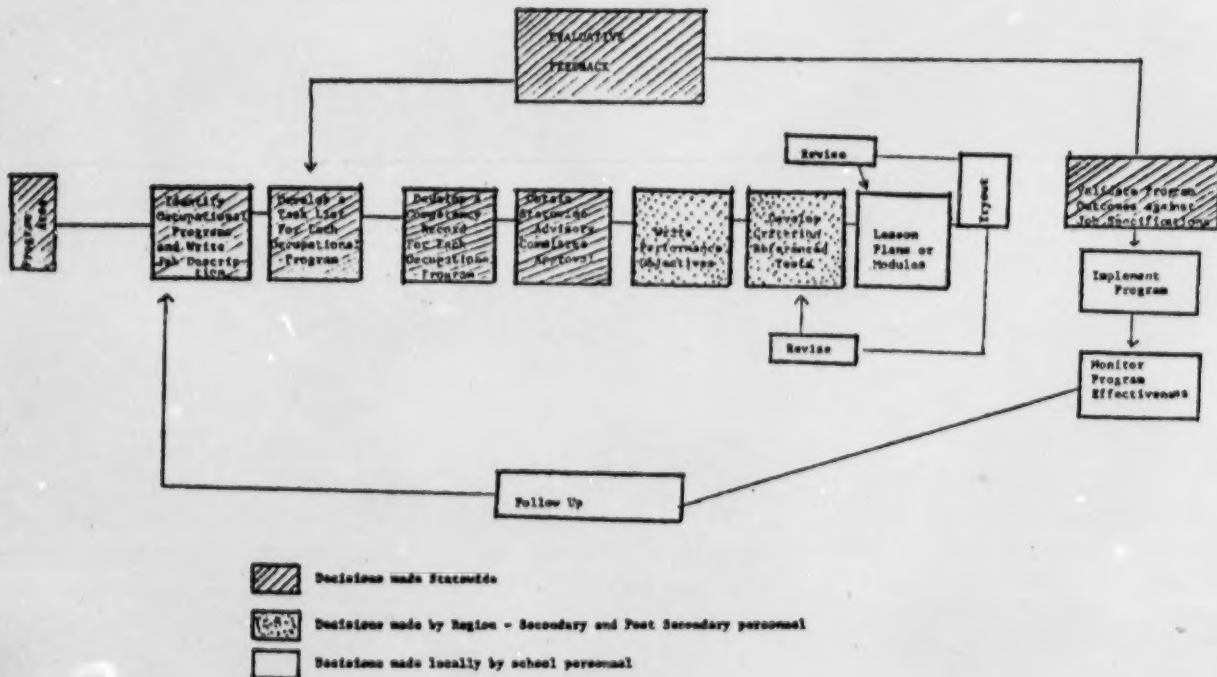
CURRICULUM ARTICULATION PROJECT	
TERMINAL PERFORMANCE OBJECTIVE	
Automotive Mechanic	
Area of Competence	#6
Statement of Competence	IA
task(s)	L
Given these conditions:	
VEHICLE OR BRAKE SYSTEM UNIT	
You, the student, will be able to:	
CHECK OPERATION OF BRAKE SYSTEM	
So well that:	YOU CAN DETERMINE IF THE BRAKE
or	SYSTEM IS IN NEED OF REPAIR
According to:	ACCORDING TO PEDAL ACTION AND HEIGHT.
Student performance will be measured by:	
☐ performance test (teacher made)	
☒ performance test (standardized for the region with procedures for administration written down)	
☐ written test	
☐ verbal test (oral)	
The test will be administered by ☐ teacher ☐ student ☐ testing agent	

(Example)

Teachers are encouraged to develop tests as a group so that students will be assessed as competent or not, based upon the same test.

SUMMARY

The chart below shows the articulation process. It includes actions taken at the state, regional and local levels.



(Appendix)

ARTICULATION SESSIONS

Agendas for Instructors' Articulation Sessions
May Include the Following Entries:

1. Payment for participants
2. How the task lists were developed
3. How to read the task lists
4. What is a competency record
5. The purpose of the exploratory program
6. The need for curriculum articulation
7. Description of teachers' local programs and facilities
8. Decisions about tasks that could be included in a high school program
9. Differences between high school and center programs
10. Overview of what the articulation effort requires of participants
11. Summary of actions and decisions to date
12. How to write terminal performance objectives (TPO's)
13. Explanation of the guidance transparency for writing TPO's
14. Writing of beginning level terminal performance objectives by teachers using the task list booklets (work in groups with assistance given by consultant-on-site)
15. Editing of terminal performance objectives (opaque projector)
16. Contract with one or two teachers to finish writing more advanced TPO's and to review and edit all objectives for the final typing
17. Review typed, edited objective and decide upon testing procedures as shown on the bottom of the TOP worksheet
18. Explanation of criterion referenced testing
19. Review use of competency record and grading scale
20. Print copies of TPO's and give to all participants
21. Discuss how to use TPO's and competency records to implement competency based instruction
22. Establish a timetable that shows what secondary programs will accomplish. Anticipate what students' competency records will look like upon entering the AVTI. (Note: if group instruction is to be used at the AVTI, then the areas of competency and the terminal performance objectives should be consistent across schools, with time determining the number of TPO's undertaken, not the depth of instruction)
23. Make group decision about what programs should look like - content taught, task lists to be completed
24. Secure input from local advisory committee
25. Print competency records for regional use

Equipment, materials and/or handouts needed

Task list booklets (1 set for each instructor)
Roll sheet
Lunch tickets for cafeteria

Room for group meetings
Opaque projector
Overhead
Transparancies/with markers
Worksheet for TPO writing
List of dates for all meetings (group can revise)
Flow chart
Orange booklets
Handbooks
How The Task Lists Were Developed (handout)
Slide Tape presentation, "Using a Task List"
Booklets on Developing Performance Tests
Booklets on Developing Written Tests
Names, addresses and phone numbers of all participants
Financial notebook (consultant-on-site)

END OF PHASE I

Phase II to be added as Pilot efforts progress

APPENDIX F

PRODUCTS DEVELOPED BY
THE STATEWIDE CURRICULUM ARTICULATION PROJECT TO DATE

1. Burger, Laura; Lambrecht, Judy; Allen, Deena; and Loeb, James:
Handbook for Vocational Instructors Interested in Competency Based Education, 1974. Research Coordinating Unit for Vocational Education, University of Minnesota, Minneapolis, Minnesota. (Available through ERIC, AIM/ARM, and MIMC)
2. Burger, Laura:
Developing Articulated High School and Post High School Vocational Technical Curricula in Minnesota; A Final Report, 1975. Research Coordinating Unit for Vocational Education, University of Minnesota, Minneapolis, Minnesota. (Available through ERIC)
3. Burger, Laura; Allen, Deena, and Loeb, James:
Competency Based Route to Vertical Curriculum Articulation, 1975. Research Coordinating Unit for Vocational Education, University of Minnesota, Minneapolis, Minnesota. (Available through MIMC)
4. Automotive Task Lists:
Automotive Mechanics, Service Center Mechanics, Lubrication Specialist, Exploratory Program for Auto Mechanics (1975). (Available through MIMC and AIM/ARM)
5. Secretarial/Clerical Task Lists:
Office Services Aid, Typist, General Office/Typist, Secretary/Non-Shorthand, Secretary/Shorthand, Data Entry Operator, Medical Secretary, Legal Secretary, Educational Office Personnel, Correspondence Specialist and Administrative Assistant, Correspondence Supervisor. 1976 (Available through MIMC and AIM/ARM)
6. Terminal Performance Objectives for Competency Based Instruction. Automotive Mechanics Occupations. A directory was developed in each of the eight funded sites.
7. Burger, Laura and Allen, Deena:
Competency Assessment: A Vocational Instructor's Guide to Developing Written Tests, 1976
8. Burger, Laura and Allen, Deena:
Competency Assessment: A Vocational Instructor's Guide to Developing Performance Tests, 1976

9. Burger, Laura; Allen, Deena, and Kohls, Connie:
An Articulation Process Manual for Administrators and Consultants-On Site, 1976
10. Carpenter Task List, 1977
11. Food Service Task Lists:
Cook/Chef; Short Order Cook; Kitchen Assistant; Waiter/Waitress (including Host/Hostess); Counter Worker (Fast Service Restaurant); Bus Person; Cashier; Baker; and Bakery Salesperson, 1977
12. Accounting Task Lists:
Accounting Clerks: Accounts Receivable Clerk, Accounts Payable Clerk, Inventory Clerk, Billing/Invoicing Clerk, Purchasing Clerk, Cash Receipts Clerk, Cash Disbursements Clerk; Bookkeeper; Cost Accounting Clerk; Payroll Clerk; Accountants: Public and Private, 1977
13. Terminal Performance Objectives for Competency Based Instruction. Secretarial Clerical Occupations. A directory for general secretarial clerical occupations was developed in the Bemidji site pilot. Directories for legal and medical secretarial programs were written by committees of teachers from throughout the state.
14. Criterion Referenced Tests for Automotive Mechanics Occupations. First draft developed at Rochester Pilot site.